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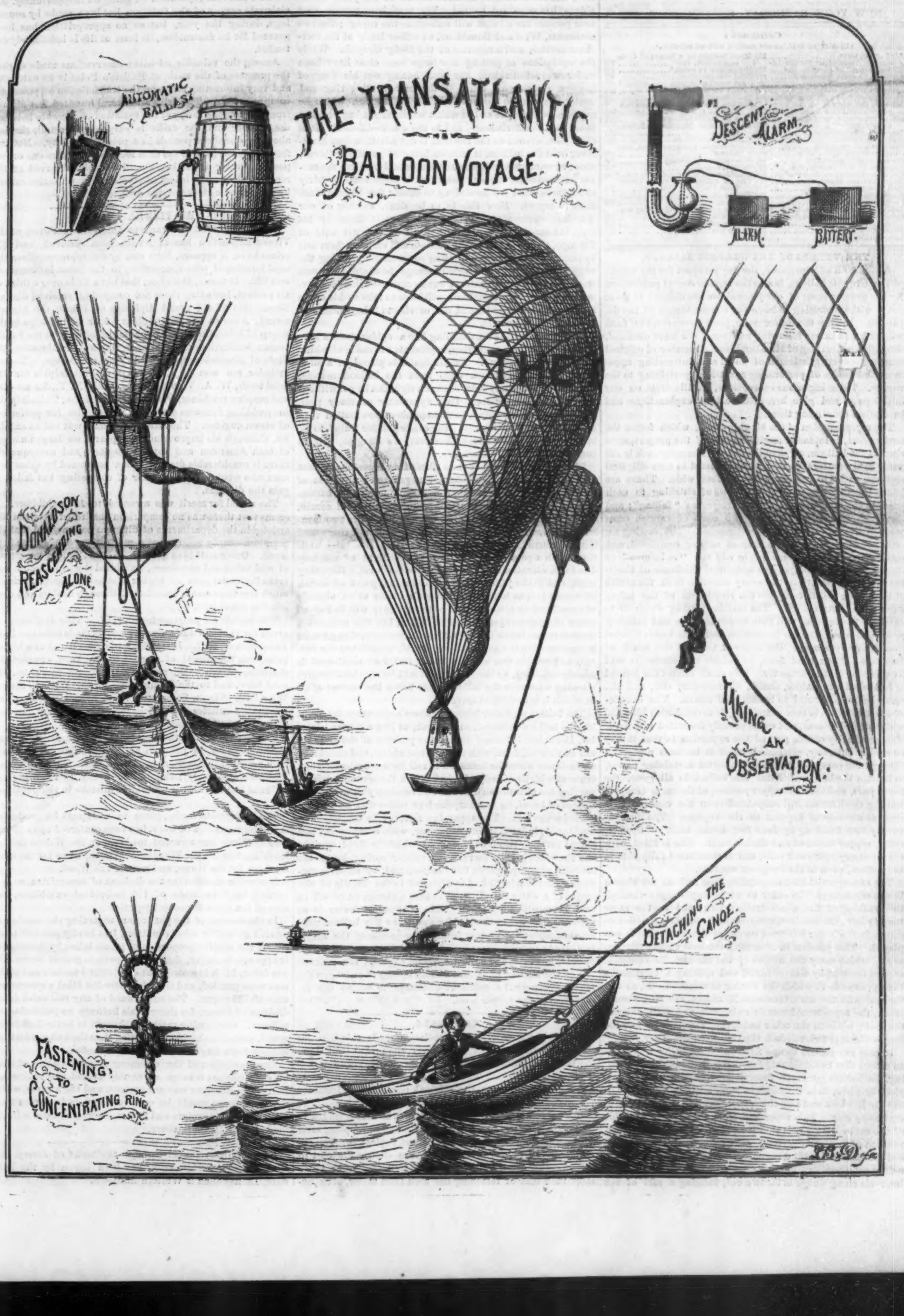

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VOL. XXIX., No. 12. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, SEPTEMBER 20, 1873.

Contents :

(Illustrated articles are marked with an asterisk.)

THE VOYAGE OF THE GRAPHIC BALLOON.

As the 10th of September, the day set apart for the ascent of the *Graphic* balloon, is also the regular day of publication for the present issue of our journal, we are obliged to go to press without waiting to learn the circumstances of the departure. In case the latter take place, however, the facts will be found in our following number. We have obtained, through the courtesy of Mr. Donaldson, a number of original sketches of that gentleman of novel and interesting apparatus and modes of performing operations pertaining to the voyage. These ingenious conceptions, we illustrate on our initial page, and give herewith various explanations and particulars concerning them.

The representation of the air ship itself, which forms the center piece, is intended to give an idea of the proportionate sizes of the balloon, car, and life boat. The great sack is 108 yards in circumference, and is constructed in nine elliptical sections, each 176 feet long by 54 feet wide. These are joined together by means of two rows of stitching to each seam, in the style known to seamstresses as "felling"; and then each seam is covered with two coats of varnish composed of linseed oil, beeswax and benzine. The sewing together of the fabric is at the time of writing completed, and nothing remains to be done but to add the "re-inforce" or crown piece, consisting of one additional thickness of sheeting extending twenty feet in every direction from the zenith of the globe; and to complete the riveting-in of the safety valve at the extreme top. The marline netting which is to envelope the balloon, will then be put in place and inflation proceeded with. The car is fourteen feet high, and is divided into two compartments, the upper of ten and the lower of four feet. The second floor, on which the aeronauts will live, is nine feet in diameter. The small cabin thus formed is furnished with tables, chairs, instruments, etc., and the space below is devoted to ballast and stores. The exterior of the car, which is now completed, is covered with blue and white striped canvas, and quite prettily decorated with flags. The peculiarity of this part of the apparatus is that it may be readily cut away, piecemeal, when it becomes necessary, through the escape of gas diminishing its sustaining power, to lighten the balloon. After the ballast is all gone, the lower part, and then the upper portion, of the car is dropped, leaving the lifeboat still suspended from the concentrating ring, as a means of support to the voyager. The boat is twenty-two feet long by four feet broad, built of Spanish cedar, copper fastened and clinker built. She is fitted with the necessary spars and sails, and is considered fully able to keep afloat, even in the roughest weather.

The arrangements for suspending boat and car are shown in our engravings. In order to avoid any danger through the breaking of the concentrating ring, and at the same time to have the netting firmly secured thereto, the device shown in the lower left hand corner of the engraving is employed. This consists in fastening the heavy ropes (sixteen in all), which carry the weight of the car and its contents, around the ring by a clove hitch, and splicing a thimble in the upper ends to which the netting is attached. If, as was the case with the unfortunate La Mountain, the ring should break, the ropes would merely swing out and still support the load; while on the other hand, they can be cut below the ring without the clove hitch slipping from the latter.

In case gas should escape from the main balloon to such an extent that the aeronauts find themselves rapidly descending, the ballast goes first, then all movables, then the car, piece by piece, then the small balloon, until nothing is left but the life boat and also the canoe hanging from the concentrating ring. Four ropes lead from the boat up outside of the car to the ring, so that it hangs from the latter, independent of any other portion. The party is now in the boat, but the balloon is still descending. As they near the water, a drag composed of a number of canvas buckets attached at intervals along a rope is thrown out, forming a sort of sea anchor and steadying the balloon. As soon as the life boat touches the surface, the sustaining ropes are cast adrift, leaving her attached to the balloon by a single line which is fastened to the bight of another rope, the ends of which pass through rings near the bow and stern of the vessel, joining amidships. At the same time, a canvas drag is veered astern, keeping the bow of the boat in the direction the balloon is travelling. This arrangement will be understood from the drawing marked "detaching the canoe," an operation afterwards performed in a similar manner. Knots in the rope prevent it being drawn through the rings in the boat in the wrong direction. At the word, one of the party cuts the line between the rings, out of both of which at once the ends are of course pulled by the balloon. The boat is then free, and sail is made. Meanwhile one of the party (Donaldson) has remained behind. We may here remark that four persons are all that will undertake the voyage; the two aeronauts, Wise and Donaldson, an officer lately of the merchant service, and a reporter of the *Daily Graphic*. While the operations of getting the large boat clear have been under way, Donaldson has been letting out his drag of buckets, securing his canoe to the concentrating ring and finally fastening to the latter two blocks, through which he reeves a rope, to one end of which he attaches a bag of sand to act as a counterbalance, and to the other—himself. It is clear that, as soon as the life boat is cut adrift, unless something hold the balloon, it will, on being so greatly relieved, shoot upwards too suddenly and dangerously. Here the canvas buckets come in play; but after the large boat is fairly clear, these must be hauled up to enable the balloon once more to ascend. How this is to be done, another of our drawings represents. Donaldson lets himself down by his cord, the sandbag balancing him, until he can get hold of the rope, then he pulls up the buckets and empties them one by one. It is hoped that, by thus so greatly lightening the balloon, it may with its single passenger be enabled to reach the European shore in safety; but in case even these endeavors prove fruitless, Donaldson will have to take to his canoe and trust to reaching land in her, or else to being picked up by some passing vessel.

The drawing of a man dangling like a spider from a line, on the right of our engraving, represents the mode of taking observations of the sun. The navigator is placed in a sling or chair, and hoisted by a whip from the balloon netting, well out on the sunny side, so that a sight can be got without the shadow of the globe. This apparently unsteady position will really, we think, be susceptible of less motion than on the deck of a rolling ship; the correction for "dip" to be applied to the observations, however, we imagine, will be something rather extraordinary.

The two upper sketches are a plan of an ingenious descent alarm and of an automatic ballast regulator, both ideas of Mr. Donaldson. The former consists of an ordinary barometer tube, A, ending below in a cup, B, filled, of course, with mercury. Passing up through the latter are two insulated wires, which, as shown, connect with a battery and burglar alarm bell. These wires extend up the tube until they reach a point, corresponding to the hight of mercury due to an elevation of 2,000 feet above sea level. Here they meet, and at the junction is a non-insulated point of metal. Of course just so long as the balloon remains at an altitude of over 2,000 feet, the surface of the mercury will be located below the point of junction of the wires, but the moment a descent occurs below that elevation, the mercury, rising, comes in contact with the non-insulated metal, establishes the current and sounds the alarm. The 2,000 feet mentioned is merely arbitrary, as the instrument will be regulated to give warning whenever the balloon sinks below the current of air in which it is desired to travel.

The ballast regulator is an ingenious contrivance for keeping the balloon balanced, so to speak, at just a certain hight. Mr. Donaldson informed us that the position of the air ship can be thus adjusted with the greatest nicety, and mentioned an instance where he managed to sail for a considerable distance at a hight of only six feet above the ground, hardly varying his altitude an inch until on carelessly throwing out a piece of bread, he was surprised to notice that he had ascended some feet. The apparatus referred to consists of a bladder, A, inflated before ascending, with common air, and placed between two boards, one of which is fixed upright and the other hinged thereto. A rubber spring keeps the movable piece up against the bladder, and, by suitable connection, the moving board is attached to the handle of the spigot of a water barrel, so as to turn a stream on or off in accordance with its motion. This connecting device is so adjusted that, when the bladder swells, as the balloon rises into atmosphere of greater tenuity, the handle of the spigot is moved to diminish gradually or check the escape of water. Should, however, the balloon descend slightly, the contraction of the bladder allows the rubber spring to pull open the faucet, and permit a sufficient discharge to enable the resumption of the proper level.

HELL GATE.

Owing to the reduced appropriation made this year for the improvement of the East River channel at Hell Gate, the work on Hallett's Point progresses slowly, very few miners being employed. The headings and galleries are nearly completed according to the original plan; still an immense volume of rock remains to be removed.

Our readers will remember that it was at first intended to remove part of the rock dry and the rest by grappling after the breaking up of the reef by a grand explosion. The experience since gained on Pot Rock has shown the cost of grappling in a current like that of Hell Gate to be much more than that of removing the rock from below, even under the unfavorable conditions that prevail at Hallett's Point. It has, therefore, been decided to sink the entire excavation under the river some twenty feet deeper, making a cavity capacious enough to engulf the shell of the reef and its supports, yet leave a depth of water above sufficient for the passage of the largest vessels. The deepening of the excavation has been begun in the Humphrey and Hoffman headings.

The skill and care with which the work has thus far been carried on give assurance of the successful completion of the undertaking at as early a date as the funds provided will admit of. Already 90,000 blasts have been fired, consuming 33,000 pounds of nitro-glycerin, without a single accident—a remarkable record for an explosive material having such an ominous reputation for going off inopportunely. An elaborate survey of the Gridiron has been made by soundings, during the year, but as no appropriation has been granted for its destruction, its lease of life is indefinitely extended.

Among the valuable scientific observations made during the progress of the work at Hallett's Point is an extensive and very interesting series on the transmission of power by compressed air. The drills are several hundred feet distant from the compressors, yet the variation of pressure between the receiver and the drills is surprisingly small, ranging about two or three pounds in a pressure of fifty. Not unfrequently the gage at the drill records a pressure one or two pounds greater than that simultaneously observed at the receiver, the excess being attributed to a pulsation caused by the periodic stroke of the drill.

THE VIENNA PRIZES.

The complete list of awards to American exhibitors at the Vienna Exposition has at length been received, and 359 prizes have, it appears, been won by our representatives, the total number of whom, according to the latest information, was 922. It seems, therefore, that but a little over a third of all present, including those not competing, received distinctions. Out of 412 grand diplomas of honor, the highest award, America has taken eight; four of these go to the group of Education, and are given respectively to the Smithsonian Institution, the National Bureau of Education, the State of Massachusetts, and the city of Boston. The remainder are won by S. S. White of Philadelphia for artificial teeth, W. A. Wood, Hoosac Falls, N. Y., for mowing and reaping machines, William Sellers & Co., Philadelphia, for puddling furnaces and tools, and Corliss for perfection of steam engines. The latter gentleman was not an exhibitor, although his improvements appeared on large numbers of both American and foreign engines, and consequently there is considerable dissatisfaction expressed by other persons who went to the expense of competing but failed to gain the diploma.

The medal for merit was awarded to 155 exhibitors. It seems that there was no comparison instituted between like articles in the departments of different nations, and that the premium simply means that a meritorious display has been made. One medal is as good as another, so that inventions of real value and excellence, exhibited by originators and manufacturers, gain no higher distinction than articles of much less importance contributed through dealers and commission merchants.

The medals for progress number 57. This distinction is given for valuable designs or inventions made since the Paris Exposition of 1867. It may be fairly considered as a higher prize than the medal of merit. It has been awarded for chromos, photographs, several agricultural machines, the sand blast, and to the Remington, Howe, Wilson, Singer, Wheeler & Wilson, Secor, and Weed sewing machines; besides other articles, of which, for lack of space, we are obliged to omit mention.

The medal for good taste was designed for artists who do not compete for the progress or merit medals. Four have been awarded to Americans, two of them being to artists (Bierstadt and Healy); and, strange to say, two to makers of artificial teeth, which is probably a mistake in the published list.

The coöperative medal, given to assistants for producing meritorious articles of work, has been conferred upon 19 persons. Three are awarded for labor on the Wilson Sewing machine, two for the Wheeler & Wilson, three for the Singer, three for the Howe, and one for the Weed.

Honorable mention (or the diploma of recognition, as it is termed) has been made of 116 individual exhibitors, and also of ten cities for school reports.

In the absence of the particulars regarding the number of awards gained by other countries, it is hardly possible to estimate the relative proportion of prizes taken by Americans. It appears, however, that the comparison cannot be much in our favor, for it is stated that over 30,000 medals and diplomas were granted, and that the mere list filled a quarto volume of 529 pages. The only award of any real value is the diploma of honor, for the medals indicate no particular excellence. Our sewing machines, known to be the best in the world, gained no higher distinction than the awkwardest imitations from English and German factories.

The description of the ceremony of presentation of medals characterizes it as an extremely stupid and tedious affair. The Emperor was not present, and the awards, which it was supposed would be conferred by him in person upon distinguished inventors and others, were read from a list in the hands of Baron Senborn.

A NEW railway tunnel through the rocks of Jersey City Hights, opposite New York, has been begun by the Delaware, Lackawanna & Western Railroad.

THE PATENT ICE MACHINE.

An interesting case pertaining to the artificial production of ice has lately occupied the attention of the Commissioner of Patents. We allude to the application of F. P. E. Carré for an extension of his patent for ice machines, patented in France in 1859, and in this country in 1860.

The Commissioner has refused the petition for extension, and the invention is now public property.

The general method of effecting congelation by artificial means is to make use of a liquid which will energetically assume the gaseous state at a low temperature. In passing from the liquid to the gaseous state, the gas takes up a large amount of heat, and it draws this heat from whatever body it happens to be in contact with. This phenomenon may be readily illustrated by pouring a few drops of water upon a plate, and resting the bottom of a watch crystal on the plate in contact with the water. If now a small quantity of ether is placed in the watch crystal, the ether will evaporate or assume the gaseous form with great rapidity, and will draw so much heat from the water as to freeze it. This is the general principle on which most of the ice machines operate, and various refrigerating liquids are employed. In some of the machines ether is used, in others sulphuret of carbon, in others the light liquids from petroleum. These substances, after having passed from the liquid to the gaseous form, may be again restored to the liquid condition by the application of pressure, to wit, nearly 100 lbs. to the square inch. For this purpose pumps worked by steam engines are usually employed, but the great pressure of the gas results in much leakage and consequent loss of power; and until Carré brought out his improvement, the business of making ice was always attended with difficulty and expense.

In the Carré apparatus, a boiler containing ammonia and water is used, to which heat is applied, and pressure produced whereby the ammoniacal gas is driven over and condensed in a suitable receptacle in liquid form. The pressure is then shut off, when the ammonia immediately begins to boil and expands into the gaseous form with energy. The chamber in which the ammonia is allowed to expand surrounds a vessel of water, from which the expanding gas absorbs caloric, and the water congeals. The ammoniacal gas is then brought into contact with cold water, by which it is absorbed, and the ammonia water is then returned to the boiler and again used in the manner described. The process of ice manufacture is thus made continuous. There is little or no waste of ammonia, for it simply circulates around through the apparatus in pipes and chambers, condensing at one point and expanding at another as required, no pumps being required to effect the condensation.

The wonderful absorption, by water, of ammonia renders the use of this agent especially advantageous over any others at present known, for the purpose of ice-making. At the ordinary temperature, water absorbs over seven hundred times its volume of ammonia, while the latter may be readily expelled from the water by the application of heat. It requires a temperature of 103° Fahr. below zero to solidify liquid ammonia. Placed in an iron vessel, it produces, at a temperature of 50° Fahr. a pressure of 97½ lbs. to the square inch. It was used at one time in New Orleans as a motor for a street car, an engraving of which appeared some time ago in our paper.

It appears, from the proceedings before the Commissioner of Patents, that the Carré ice machine is now in extensive and successful use in various parts of the country, especially at the South. The city of New Orleans is chiefly supplied with ice made by this apparatus, which furnishes ice for $5 a ton less than the price at which it can be imported from the North. The Carré machine is one of the most valuable inventions of the day, and it is not therefore surprising that the makers of all other ice machines, who have heretofore been compelled to use condensing pumps, should appear in full force at the Patent Office, to prevent the extension of the Carré patent. In this they have succeeded; and now they may throw aside their steam engines, discard their expensive pumps, and adopt the simple, effective and brilliant invention of Carré.

What surprises us is that the Commissioner of Patents should have rejected Carré's petition on the slender reasons that he assigns. He states that Faraday bent a glass tube into U form, and put ammoniated chloride of silver in one end, to which heat was applied. The result was that the ammonia was driven over and liquefied in the opposite end of the tube, which he now dipped in water. The heat being removed, the liquefied ammonia then expanded into gas, extracted caloric from the water and congealed it, and the gas went back to the other end of the tube and was again absorbed by the chloride of silver.

The Commissioner states that all that Carré did was to take this principle, first illustrated by Faraday, and substitute it, in ice machines, in lieu of the exhausting and condensing pumps used in Twining's, Perkin's and other ice apparatuses. Carré's labors during a period of thirteen years netted him $65,000, or $5,000 a year, which the Commissioner thinks is sufficient compensation.

This decision of the Commissioner, drawn up by a Board of Examiners in Chief at the Patent Office, is only one more illustration of the worthlessness of the Washington examinations, by which inventors are too often deprived, not only of credit for their discoveries but of substantial benefit.

What Carré did was to give to the public a new and splendid refrigerating apparatus, whereby cooling chambers for the preservation of important articles of food, and the production of ice, could be readily and economically effected. This was a great achievement, something never done before and entitled the author to the highest consideration as a public benefactor. The economic advantages conferred upon this country, by the introduction of Carré's invention, already amount to millions of dollars per annum; and every year, as the use of the invention is extended, these benefits will be augmented.

In the face of these undeniable facts, which are presented in the Commissioner's report, he dismisses the petition of Carré and attempts to belittle the invention by pronouncing it merely a substitute for pumps, and merely an imitation of Faraday's tube. Faraday's glass tube experiment was made public in 1823, but remained inert and useless, so far as practical ice manufacture was concerned, for more than a generation. It was not until Carré, in 1859, produced the present invention that ice could be economically manufactured, and but for Carré it is probable that we should not now be in possession of this remarkable and invaluable process. The Commissioner's conclusion is narrow-minded and erroneous. A device which is merely a substitute for an other, is only capable of the functions of the original. Carré's invention was far more than a mere substitute. It eliminated from ice machines all the difficulties that had attended their operation. It rendered them effective, economical, and commercially practical, when before they were expensive, leaky, and well nigh useless. The tube of Faraday was a brilliant experiment, illustrating a novel principle. But, commercially speaking, it was not an ice machine. It required more than thirty years of time and the inventive genius of a Carré to give the principle practical embodiment, or harness it into duty for creating ice.

The action of the Commissioner of Patents in decrying the merit of Carré's discovery we regard as a disgrace to the country; and we trust that the next Congress will make prompt amends by reversing the Patent Office decision.

PENS AND THEIR FAILINGS.

It is a noteworthy fact that the man who made more steel pens than any other, and better ones,—the late Joseph Gillott—never wrote with a steel pen. With all the men and machinery at his command he was never able to produce a pen that suited him so well as the time-honored plume of the old gray goose. Mr. Gillott was not alone in his preference for the inconvenient yet easy quill. The kindly firmness of its bearing and its easy movement have never been approached by any of its metallic imitations. The iridium pointed gold pen, properly ground, comes nearest to the writing quality of the quill, and greatly excels it in durability; but gold pens are never properly ground by the makers. Steel pens, though excellent for pen drawing, are altogether too hard, scratchy, and tiresome for rough and ready writing, their persistent use resulting in that painful exhaustion of the nerves and muscles of the hand and arm known as writers' cramp—a malady due not so much to the necessary labor involved in tracing the letters as to the unnecessary and exasperating effort constantly called for in forcing the pen to go the way it goes hardest, and in keeping it from swerving right and left into easier paths: a malady, it may be added, which dates its origin from the introduction of steel pens, and which is demonstrably not caused by the chemical action of the ink and the resulting electric currents, or anything else save the vicious action of the pen itself.

To return to the goose feather is impossible. The supply is inadequate to meet the great and increasing demands of modern writing. For much of this literary and commercial labor, the writing machine in some form or other will be required; but there will still remain an immense amount of irregular writing which must be done by hand with metal pens; and it is time the penmakers began to furnish something approaching the good qualities of the quill. Only the blinding effect of tradition and training can account for the failure of penmakers to discover and correct the radical and plainly apparent faults of their productions. Take for illustration, the most common and mischievous of pen defects, faulty pointing.

One of the first principles of mechanical construction is that the bearing surface of any sliding tool or structure should be such that the line of least resistance shall lie in the direction in which you wish it to go. Skate irons, sled runners, and a thousand other illustrations will occur to the reader. The principle is too plain and self-asserting to be overlooked by the dullest, save in the matter of penmaking. In pens, however, the line of least resistance, if there be any, is sure to lie in any direction rather than that of the general stroke. The only effort made to lessen the resistance shows itself in giving a round point to the pen, a device most commonly adapted by gold pen makers. This is better than nothing; still it is faulty, in that it compels the user to constant exertion in keeping the stroke from wavering; and at the same time it reduces the bearing surface of the pen to the minimum, thus increasing friction and making fineness coincident with scratchiness. It is like setting an ice boat on round knobs, instead of on long and narrow runners.

To give a fine stroke easily and smoothly, a pen should rest not on a point but on an edge several times longer than it is thick, its length lying in the direction of the up stroke. By this means, the bearing surface of the pen is increased many times, and the smoothness of the writing in proportion. And as the least resistance is met in the line of the upstroke the writing will have a regular slant without any effort on the part of the writer to steady his hand. The down strokes lying at a slightly greater angle to the line of writing will, of necessity, be a trifle broader, giving distinctness to the letters, likewise without change of pressure or other effort. Sharpen a lead pencil, making one end flat and the other to a round point; then compare the writing of the two, for illustration of the position here taken.

A wrist all but crippled by the use of pens of ordinary make has compelled the writer to make a critical study of pen points, experimental as well as theoretical, for his own relief. Through the destruction of innumerable pens,—as the surgeon spoiled his "hatful" of eyes—the following process has been developed for converting an ordinary stiff, scratchy, tiresome pen into one that will glide over the paper as kindly as a quill. It is comparatively easy to give a quill point to a steel pen; but it soon wears sharp and requires frequent retouching on a fine stone to keep it in condition. A well tempered gold pen is better. Choosing one with a large point—a Mabie, Todd & Co.'s "Broad Point" is the easiest to improve,— carefully grind the back bevel-wise until the "point" presents a long sharp edge, like that of a narrow chisel, slightly oblique to the line of the slit. This done, rub the writing edge lightly on a fine hard stone, holding the pen as in ordinary writing. This will give a bearing surface as above described. The outer and inner corners of the edge and those at the slit will require a few light touches to round them slightly. Any roughness due to the coarseness of the stone may be removed by delicate rubbing on a finer stone or on hard paper. If the pen lacks the soft quick spring of a good quill, grind or scrape away as much gold from close to the point as may be required to bring it to the desired flexibility. A pen so improved will have all the good qualities of a quill, so far as attainable with a metal so slow tempered as gold. It is impossible that, by the use of some more elastic non-corrosive alloy like American Sterling, a perfect quill action could be attained, together with durability. What penmaker will try it, and bless mankind while making a fortune for himself?

DEODORIZING THE OFFAL FROM SLAUGHTER HOUSES.

We publish, on another page, an illustrated description of an invention and process for treating the offal from slaughter and rendering houses, and converting it into a fertilizer. This subject is most important from a sanitary as well as from an economical point of view; and this new system is probably destined to come very largely into use. In Chicago, the health authorities have suppressed the use of all other apparatus for this purpose, on the ground that the hygienic necessities of the case were not complied with, leaving the Storer method master of the field.

SCIENTIFIC AND PRACTICAL INFORMATION.

SILICA LENSES.

In a new work entitled *Telescope and Microscope*, recently published in France, the following method of obtaining a lens for a cheap microscope is ascribed to an experiment of Sir Humphrey Davy. The process consists in igniting one end of a wheat or hay straw and allowing the entire spear to consume gradually. The cinder is then heated in the blue flame of a burner; and from the silex contained, a solid globule of glass is formed, said to be well suited for microscopic purposes.

MUSHET STEEL.

Professor Heeren has analyzed this remarkable metal and finds that, excluding carbon and perhaps traces of other substances, it contains 8·3 per cent of tungsten and 1·73 per cent of manganese. Untempered, this steel resists the file; but after tempering, it becomes much softer and readily yields.

AMMONIA IN PNEUMATIC TUBES.

MM. Tommasi and Michel have suggested the substitution of ammoniacal gas for air, in propelling dispatches through the tubes of pneumatic systems. First combined with water, the gas disengaged by heat enters the orifice of the tube and, being under sufficient pressure, drives the dispatch boxes through before it. On reaching the exit opening, it re-condenses, forming a vacuum in the pipe through which the boxes may be returned by atmospheric pressure. The apparatus is said to require very little fuel or gas.

METHYL GREEN.

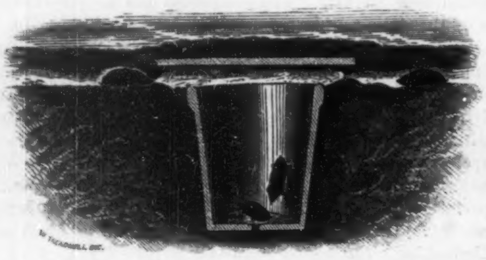
In preparing substitution products of rosaniline (fuchsin) with the alcohol radicals, instead of causing the iodine compound to act upon a salt of rosaniline, it is now customary to produce them directly by the oxidation of methyl-aniline. In this way a compound is obtained, which is chemically identical with the so-called iodine violet, but which is prepared without the use of iodine. It is known in the trade as methyl-violet, to indicate the method of its preparation. It is distinguished by its losing none of its brilliancy by artificial light. This preparation of methyl-violet could not fail to influence the manufacture of iodine green. A means was sought for causing the methyl violet to take up the radical methyl so as to form the green methylated methyl-rosaniline. In this case the use of iodide of methyl was not absolutely necessary; and in many manufactories in South Germany, the chlorine compound is used, which produces a green, crystallizing in beautiful crystals, while the iodine green is an amorphous powder; the chlorine green is also more soluble in water than the iodine. Not being obtained as a by-product in making violet, there is no foreign dye adhering to it, and a fresh dye bath gives as soft a green as one that has been used, which is not the case with iodine green, a fact generally known. Hence the so-called methyl green has two important advantages over that prepared with iodide of methyl.

First, it is more permanent than iodine green, and the solution may be boiled without decomposition. Secondly, wool is dyed with methyl green alone, it not being necessary, as formerly, to neutralize with ammonia and afterwards brighten with acid. In dyeing different shades, this is of great importance. The extensive use of iodine in the manufacture of aniline colors for the last nine years has caused a fourfold increase in its price, and was continually becoming more expensive, so that it is important to be able to dispense with it altogether.

HOW TO CATCH MOLES.

We presume there are few of our agricultural readers who at some period have not heartily anathematized the moles. Although these little animals do a considerable amount of good in killing insects and worms which would destroy grain, they more than counterbalance the benefits they confer upon the farmer by the injuries they inflict upon the work of the gardener. They appear to have a taste for the choicest bulbs and for the roots of the rarest flowers, while their tracks very speedily ruin the appearance of smooth and neatly kept lawns.

The Patent Office records show that plenty of inventive genius has been expended in attempts to devise an efficient mole trap. Of these inventions we have tried quite a number in our efforts to rid our garden of the nuisance, but we have found none so satisfactory as the very simple plan represented in our engraving. As soon as a fresh mole run is



found, indicated of course by a ridge on the surface of the ground, a hole should be dug and a large sized ordinary flower pot set therein. Over the top of this receptacle, a piece of board is placed, leaving a space of about three inches between it and the edge of the pot so that dirt from above will not fall into the latter. The openings of the run lead, as represented, into this space. The earth is replaced and the surface of the ground restored. The mole in following his usual road blindly comes to the orifice leading to the pot, into which he incontinently tumbles. As he is unable to crawl up the sides or burrow through the hard earthenware, he decides to remain and wait for assistance, which generally comes in the shape of a gardener and a rat terrier. The transactions of the mole with the last mentioned of this pair are such as to destroy his taste for bulbs or for future mining investigations.

In using this device, we caught seven moles the first day and three on the second day after setting. Since then we have captured one occasionally. The result is a marked improvement in the aspect of our lawn and flower beds. The trap was contrived by George Becker, a gardener in Llewellyn Park, Orange, N. J., and is not patented.

Water Gas.

The improvements of W. D. Ruck are now in successful operation at the gas works of Chichester, England, and that city is now lighted by the new method, which is described as follows in *Engineering:*

The elements are water, coke, iron, and spirit. The water is converted into steam, which is passed through a superheater, and then through a set of retorts containing coke and iron, the charge for each retort being 1¼ cwt. of coke and 1 cwt. of iron. One tun of coke put in and worked off, plus the steam, produces 132,000 cubic feet of gas, and to effect this 2 tuns of coke are used in the furnace. The gas thus produced is passed through a condenser and a washer similar to a Coffey's still, and afterwards through a purifier containing oxide of iron. From the purifier it is conducted to the saturator, where it passes through rectified petroleum spirit, which increases the bulk of the gas about 25 per cent, so that 132,000 feet becomes 165,000 feet, the cost of which is stated to be 40 cents per 1,000 feet.

In carrying out the manufacture of water gas at Chichester, the gas works have been only partially altered, so that the manufacture of coal gas is still carried on; the public, in fact, being supplied with a mixture of the two gases. This, it would appear, is the most economical method of applying the water gas, inasmuch as the coke from the coal gas can be utilized, and the latter gas can be made from cheap coal, as the former is found to be a very rich gas. Hence gas companies will probably find the water gas process useful as a supplementary manufacture while and whenever coal is dear, for it is not intended that it shall supersede the ordinary manufacture. At any rate, present experience at Chichester goes to place this beyond a doubt, for there a pure and brilliant combined gas is produced, having an illuminating power of 18·50 candles. The city and environs of Chichester have for some six or seven weeks past been lighted by a mixture of the two gases in proportions varying from one third to two thirds, the present proportions being equal parts. Arrangements have been made for lighting the city for twelve months with this gas. In order to demonstrate to those interested in gas making that the process can be applied to existing works practically and economically, more than a hundred gentlemen, the greater portion being gas engineers and managers, recently visited the works. They were conveyed from London to Chichester by special train, and when there saw the whole process in operation, explanation being given by Mr. Spice and Mr. Quick, the engineers to the new gas company. Mr. Spice was put under cross examination by several gentlemen who were skeptics on various points, but he reasonably and conclusively answered every argument brought to bear against the new gas, both with regard to details of manufacture and commercial points. At the Chichester works coal costing 30s. per tun was formerly used, while an inferior coal at 21s. is now employed in the retorts, the resulting coke being utilized in producing the water gas. The stability of the gas has been proved by keeping it for six months, at the end of which time it is stated no separation or condensation had taken place. Its travelling capacity is shown by the fact that it has been delivered by itself, and is now delivered in combination with coal gas to lights 2½ miles from the works, and burns freely. That the lighting of the city is all that can be desired was admitted by the visitors who strolled through the streets after dark, previously to their return to London. The new gas has been subjected to the test of a reduction of temperature to the extent of 27 degrees without its illuminating power being affected. In fact everything appears to have been done to prove in it a commercial manner, the greatest proof of all being its practical adoption at Chichester, by which, up to the present time, it is shown to be a scientific as well as a commercial success.

DEEP SEA DREDGING APPARATUS.

The headquarters of the United States Fish Commission have been established for the present season at Casco Bay, Me., and the work to be accomplished consists in exploring the waters and sea bottom in the vicinity in order to obtain all ascertainable facts relative to the animals inhabiting that region. The Blue Light, a steamer of 85 tuns, has been fitted with all the latest appliances and machinery, and placed at the disposal of the Commission.

We extract from the *Tribune* the accompanying illustrations of the instruments employed in deep sea explorations, the most useful of which is the dredge, which, in its present

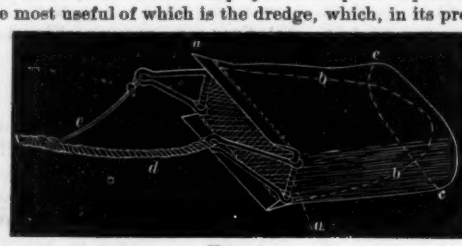


FIG. 1.

form, is capable of scraping, from the ocean floor, everything lying in its path. It consists of an open iron frame (*a* in the engraving, Fig. 1), which acts as a scraper, and to which is attached a fine meshed net, *b*, about four feet in length. Over the net, a canvas bag, *c*, open at the bottom, is extend-

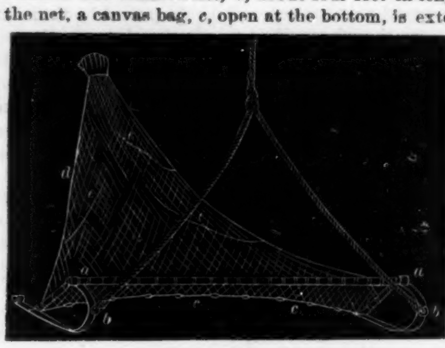


FIG. 2.

ed, serving to protect the former from injury while it is dragged over rocks. To extricate the implement in case it becomes caught on any obstacle at the bottom, the drag rope, *d*, is attached to only one of its handles, and is connected to the other by a light line, *e*. It follows that, when a hard strain comes, the light line breaks, and the heavy rope pulls thereafter at one end of the frame. The obvious result is to

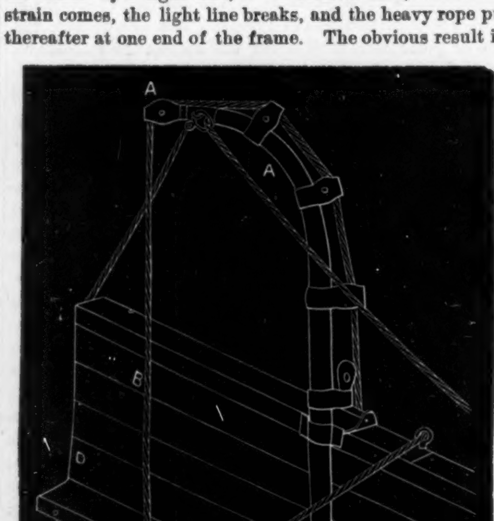


FIG. 3.

pull the scraper sideways out of its predicament. This is a simple modification of an old device, and is quite efficacious. To bring the scrapers down to their work, a weight of about twenty pounds is attached to the drag rope, one or two yards in advance of the dredge.

The specific value of the apparatus is as a scraper, as it brings up an abundance of material from the sea bottom; but where the bed is comparatively smooth, and the chief object in view is to obtain fishes and other active marine animals characteristic of the locality, the trawl (Fig. 2) is a more serviceable instrument. The front of the trawl is a beam, *a*, in our second figure, ten or twelve feet long, to the ends of which are affixed curved iron shoes or runners, *b*. From it depends a funnel shaped net, *c*, of perhaps thirty feet in depth, weighted by a string of leads, *d*, on the forward lower edge. These weights and that of the runners are sufficient to sink the trawl, and it does not usually need an extra weight in front, on the drag rope, as does the dredge. Projections or webs, *e*, proceeding from the inside of the net, called pockets, serve to prevent fishes captured in the net from getting out by the route that they go in. Over a smooth bottom and meeting no obstructions, such a trawl may be dragged along for hours at a time, till it grows so heavy with its accumulated treasures that its safety requires that it be hauled up and emptied. But, on the other hand, it may catch suddenly. Having caught, unless the strain is at once relaxed, it will be torn to pieces. On the other hand, if skillfully managed, it may be made to bring up almost anything which it incloses, and there is shown at the landing near the laboratory, on this island, a rock weighing nearly a quarter of a tun, which the Blue Light brought up in the trawl. The problem, therefore, is, when the trawl catches, to relieve the strain at once, and this accomplished in the following manner: The trawl, suspended by a strong rope, is let down rapidly from a davit on the bow of the steamer, until the slackening of the rope indicates that bottom is reached; the steamer meanwhile moving slowly backward till a suitable angle is secured, so that the trawl will drag properly over the sea bottom. Then, while the rope is still running out, a seaman swings himself out on the davit and ties one end of a light line, called the check-stop rope, with a skillful knot, fast to the drag rope, and the other end to the side of the vessel. The business of trawling is now fairly begun, and the steamer is backed slowly along over the ground selected, at the rate of about a mile and a half per hour.

Fig. 3 shows this check-stop arrangement; *a* is the davit, *b* the drag rope, and *c* the check-stop line.

The trawl is now dragging from the bow and suddenly catches on the bottom. The strain has been all along on the check-stop rope which now parts with a snap. Instantly the order is given to reverse the engine; but long before the motion of the boat can be changed, the slack of the drag rope, which this simple contrivance has provided, relieves the strain, and time is afforded to let it out until the motion changes. The boat is then run rapidly forward until it stands over the sunken trawl, the steam engine winding in the drag rope. Then, with a little dextrous management, the trawl is easily pulled away. This device entirely takes the place of the costly accumulators used in the telegraph cable service, instruments which interpose a sort of drum made of india rubber in place of part of the drag rope, the elasticity of the material serving to release a heavy strain.

The Heart and the Circulation of the Blood.

Dr. Marey, says *Les Mondes*, has recently demonstrated that the heart acts like all mechanical motors in that the frequency of the pulsations varies according to the resistance which it meets in driving the blood through the vessels. When the resistance becomes greater, the throbs diminish; they accelerate, on the contrary, if the opposition becomes less. During life, the action of the nervous centers makes itself felt on the heart, of which it renders the pulsations slower or quicker, whatever may be the resistance experienced. Dr. Marey eliminated this nervous influence by removing the heart of an animal, and causing it to work under purely mechanical conditions. The heart of a turtle was arranged with a system of rubber tubes representing veins and arteries. Calf's blood, defibrinated, was caused to circulate, and a registering instrument noted the amplitude and frequency of the movements of the organ. When the tube containing the blood leaving the heart was compressed, the liquid accumulated in rear of the obstacle and the heart emptied itself with greater difficulty, the pulsations weakening perceptibly. On relaxing the pressure, thus allowing free course to the blood, the throbs accelerated rapidly.

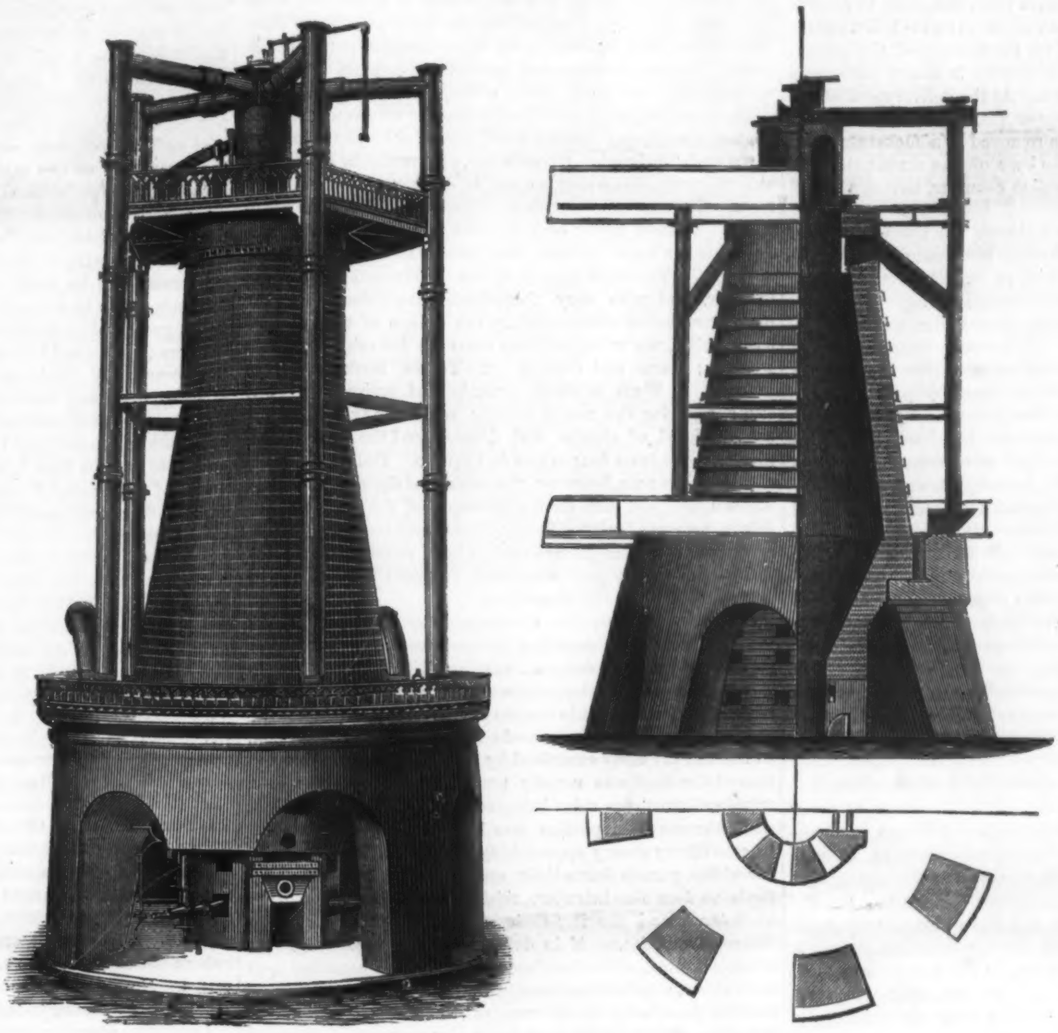
Pure Sub-Iodide of Mercury.

Lefort recommends the following method for preparing the sub-iodide of mercury free from iodine and from metallic mercury: 60 grains of pure crystallized pyrophosphate of soda are dissolved in 300 grains water, and 30 grains acetate of the suboxide of mercury added. The solution requires several hours, during which it is frequently shaken. If the soda salt is chemically pure, the mercury salt dissolves perfectly; but this is seldom the case, and the excess of alkali precipitates some oxide of mercury, so that the solution requires filtering. It is then still further diluted with water, and a solution of 30 grains iodide of potassium in 2 ounces of water gradually added with constant stirring or shaking. This produces a precipitate which is at first a brownish green, but becomes a bright green, closely resembling oxide of chromium, and on settling acquires a yellow green color. If the mercury solution contains any mercuric salt at the start, some biniodide of mercury is formed, giving the liquid a pinkish color; but this is easily avoided by adding a slight excess of iodide of potassium, which is so dilute as not to decompose the sub-iodide, while it is able to dissolve the biniodide. The precipitate is washed with cold water by decantation, collected on a filter and dried with gentle heat in the dark.

A NEW SYSTEM OF CONSTRUCTING BLAST FURNACES.

Mr. Franz Buttgenbach, manager of the Neuss Hutte iron smelting works on the Lower Rhine, has prepared a report on his system of smelting iron, to be read at the meeting of the Iron and Steel Institute, held at Liège last month. In organizing this arrangement, the inventor's object has been to obtain a blast furnace, the hearth of which should be readily accessible on all sides; and following up this idea he built up a blast furnace 50 feet high and 17 feet in diameter at the boshes. In 1867 a model of the above named blast furnace was exhibited in Paris, and was highly approved by a great number of engineers of every nationality.

The inventor states that the fundamental idea of this mode of construction, and the advantages of the system, may be summed up as follows: (1 The mason work of the stack is quite independent of the blast furnace proper. Each ring or course of brick constituting the hearth, boshes, and inside wall is readily accessible and free from any casing, except as regards a small portion, measuring from 3 feet to 4 feet in hight at the widest section of the blast furnace. Consequently, the whole of the above several parts are completely bare and easily reached for any purpose required while the furnace is in active operation. This feature conduces to the duration of the furnace, for in case of need any injured part can be repaired even when the furnace is at work. (2) The inside wall and the upper part of the boshes being cooled by the atmosphere having access thereto, they remain in the normal condition without wear, and do not become unduly heated at any time, being therefore indefinitely kept in a state of preservation, since there never occurs a fusion of materials at this hight. (3) The hearth and the lower portions of the boshes may be replaced without any difficulty whatever while the work is going on, so that there is no occasion to apprehend any extinction of the fires so long as the in-wall is not destroyed. The hearth and boshes can be renewed without affecting the in-wall injuriously. (4) Each particular brick being accessible during the working of the furnace, corrosion can be obviated by cooling down with water thrown on the several parts, or by means of water vessels or tweers, whereby the wear and tear can be checked. (5) The utilization of the gas at the furnace mouth can be so managed as to make it yield the best results. The pillars supporting the platform of the furnace top are gas pipes, and drop into sheet iron vessels fixed to the summit of the base of the stack where it slopes away. These vessels are open on one side, so that, when filled with water up to a certain hight, they can be shut down by means of a valve measuring a few inches square. The gas issuing forth out of the furnace mouth finds its way into these receptacles, and in its passage through them travels over a large surface of water. Here it deposits the dust, while a great part of the water, suspended in the gas in a state of vapor, is condensed. Consequently the gas reaches its destination in a highly purified condition, and may yield the very best results in those parts where it is desired to make use of it. The arrangement of the said water receptacles allows of the withdrawal of the dust or grit deposited while in full working, and in the event of an explosion the area, of but a few square inches, of the water column paralyzes, as though it were a gigantic valve, any injurious effects. Explosions from time to time serve the purpose of clearing off the dust and grit that may still be clinging to the inner walls of the pipes. Moreover, there is the advantage of confining these subsidiary appliances to a spot on the works, which does not in any way interfere with the general progress of the manufacture. (6) The gas pipes, being supporters also of the platform surrounding the furnace mouth or top, render the said platform independent of the blast furnace proper, and that without involving any special outlay.



BUTTGENBACH'S IMPROVED BLAST FURNACE. Fig. 1.

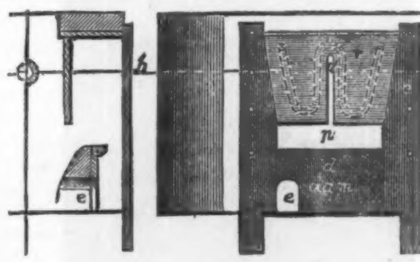


FIG. 2.

The inventor, whose extensive experience entitles him to speak with authority, states that he has been using this method for the last six years with the very best results. Its application is very simple indeed, and free from the objectionable features of other known methods, since the work of the bottom of the furnace can be performed in case of need without depending upon the mouth of a tweer for running off the slag.

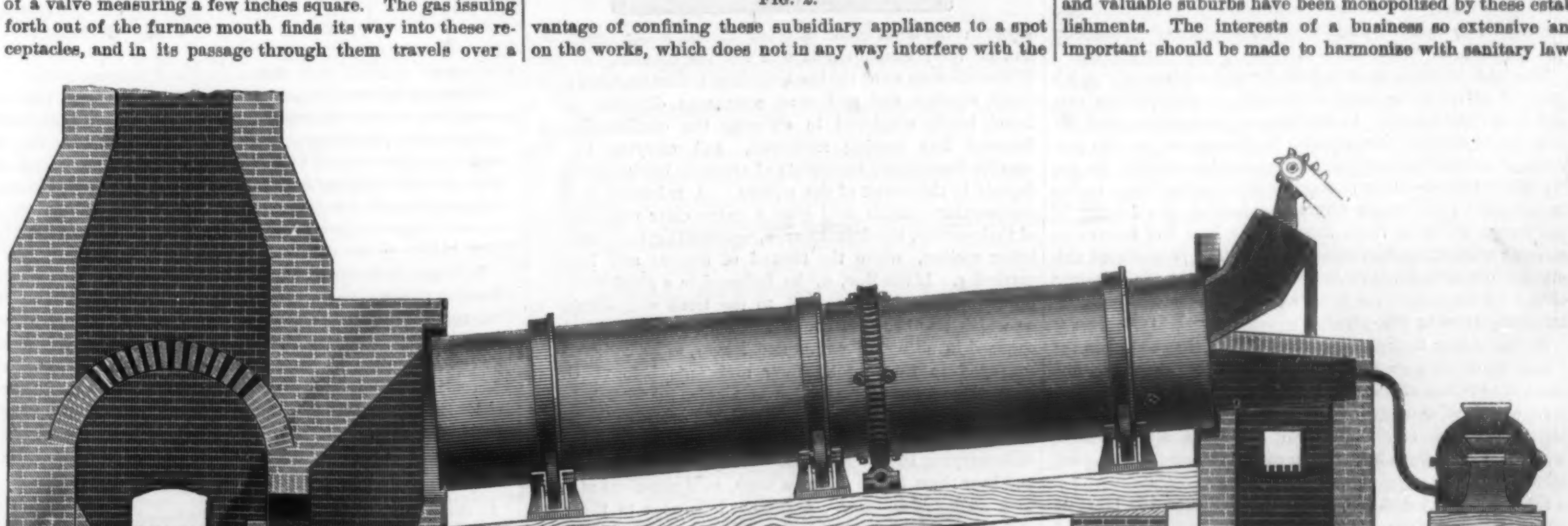
The hearth is closed in by a cast iron tymp placed in the usual position (see Fig. 2). This tymp arch is cooled by a current of water passing through a coiled iron pipe fixed in the cast iron. In the center of this plate, there is an aperture or orifice measuring 0·75 inch, running almost over the entire hight, and the cooling pipes are situated as near this kind of slit as may be. This slit is closed up by means of ordinary clay. A, the upper portion of the slit, is placed two or three inches higher than the center of the line of the tweers.

b is the level center of the tweers, *c* the columns of the breast, *d* the dam, *e* the tap hole, *p* the space between the dam stone (tymp closed in with clay), T, cast iron tymp. The slag of the blast furnace, ascending above the dam stone and reaching the level of the tweers, runs off easily through a hole driven by means of a light steel bar into the said slit; and since the level of this hole may be altered at will, a means is thus afforded for changing the level at which the slag is run off over a range of 24 inches, which is a very great advantage in itself; but, in addition to that, there is this further facility, namely, that nothing hinders one from tapping the melted ore at this same slit.

We are indebted to the *Engineer* for this illustration and for part of the explanation thereof.

HOW TO CONDUCT SLAUGHTERING, PACKING AND RENDERING WITHOUT OFFENSE.

The subject of the disposition of the offal from slaughtering and packing houses, at present agitated in all our great cities, has become a matter of national importance. These establishments are necessary to civilized life, and therefore have legitimate claims to existence; but the people who suffer from the offense caused by them have also a right to insist that they shall be carried on without injury to health or property. In many instances, otherwise most desirable and valuable suburbs have been monopolized by these establishments. The interests of a business so extensive and important should be made to harmonize with sanitary laws



STORER'S DEODORIZING CYLINDER AND PROCESS FOR CONVERTING OFFAL INTO FERTILIZERS.

and rights of land owners. Suggestions to this effect have been made and many plans devised, and we now present to our readers a plan which is claimed by the inventor to be the quickest and most comprehensive method of accomplishing the end. All the offense from these establishments arises from the manipulation of the blood and offal.

By the apparatus and processes of Jacob J. Storer, of Boston, these are so handled and treated that no cause of complaint can exist. The accompanying engraving illustrates the revolving deodorizing cylinder, designed by Mr. Storer, for converting the blood and offal into fertilizers. The cylinder consists of a boiler shell lined with fire brick. It is set at a slight incline for the more ready delivery of the dried fertilizer, is supported on friction rolls, and made to revolve by gear or belt. At the feed end of the cylinder is a fireplace in which a fire is maintained for the ignition of the pulverized fuel, which, under the Whelpley & Storer patents, is the principal agent of the work. At the delivery end of the cylinder is a receiving chamber or pit, into which the dried material falls, and whence it is removed by a bucket elevator. Just beyond this pit, and in the base of the smoke stack, is the gas mingling and combustion chamber, having a dome-shaped perforated roof.

This machine is operated as follows: The fire is urged in the first fireplace until it has become hot enough to instantly ignite the pulverized coal, which is injected over it by the pulverizer or blower, as shown in the engraving. The jet of burning pulverized coal, entering the cylinder, quickly heats it to the desired temperature. At the same time, the fire on the grate in the gas combustion chamber has brought the walls of the chamber and the perforated dome to almost a white heat. The cylinder is then put in revolution at the rate of four tuns a minute, and the blood and offal, separately or together, are fed into it by an elevator. The material, as it passes through the cylinder, is exposed to the direct contact of the flame and products of combustion, and to the direct radiation of the hot brick lining of the cylinder. As it contains from fifty to eighty per cent of moisture, an enormous volume of steam and gases is immediately generated. These move forward into the gas-mingling and combustion chamber, and, by the high temperature therein maintained, are decomposed and burned, the perforated dome retaining them sufficiently long for this purpose. There escapes, then, through the perforations of the dome, an intense white flame, of sufficient volume to generate steam for all the purposes of the work, not the slightest offensive odor escaping.

The fertilizer is preferably allowed to discharge from this machine while it still contains from 8 to 10 per cent of moisture. It is found that, notwithstanding the high temperature in the cylinder, it cannot be charred or burned, because of its envelope of steam, while it contains this percentage of water.

A cylinder 4 feet in diameter and 30 feet long treats from 3 to 5 tuns of raw material per hour, converting it into a fertilizer containing not more than 10 per cent of moisture. A cylinder 6 feet in diameter and 50 feet long will treat from 10 to 15 tuns per hour, according to the character of the material, or above 250 tuns per diem.

The capacity of these machines and their rapidity of work are such that one of them will dispose of all the refuse of any one of our large cities, obviating the necessity of an hour's accumulation of raw material about any establishment. A cylinder of 5 tuns capacity per hour, with necessary auxiliary machinery and buildings, can be erected for about \$10,000. Works of twice this capacity could be erected for about \$15,000.

Most of the offense of slaughtering and rendering establishments arises from the escape of tank steam and gases, from the accumulation of "tank stuff" and blood, and the manner of disposing of the "tank water." The steam and tank water are disposed of inoffensively in the following manner: The tank steam and gases are carried through cold iron coils for condensation. The condensed steam is then passed through efficient filters, while the uncondensed steam and gases—already reduced to a minimum—are carried into a combustion chamber like the one attached to the deodorizing cylinder, and there burned.

The tank water is made to flow through a series of "catch basins." Each series, used alternately, is divided into sets of two or more basins. In the first set the heaviest particles of animal matter are deposited. In the second set the particles of animal matter in suspension are deposited by the application of a proper precipitant, while the third set of basins is furnished with proper filters, for further purification of the water, and from these it may flow into the sewers or streams without contaminating them. The precipitated animal matter—which amounts to 8 or 10 per cent of the weight of the "tank water"—is removed from the basins and inoffensively dried in the cylinder.

By spreading a slight covering of fine charcoal upon the "tank stuff" as soon as it is discharged from the tanks, and upon the surface of the blood in the receiving tubs, the escape of offensive odors is entirely prevented. The same application is made to these, as well as to the dead animals, when they have been loaded into carts or boats for transportation.

For further information, address J. J. Storer, 161 Tremont street, Boston, Mass.

Progress of the Hoosac Tunnel during August, 1873.—Headings advanced from the east end westwardly, 158 feet; from the west end eastwardly, 93 feet. Total advance during month, 251 feet. Entire lengths opened to September 1, 24,163 feet. Rock remaining to be pierced, 868 feet. Whole length of the tunnel, 25,031 feet.

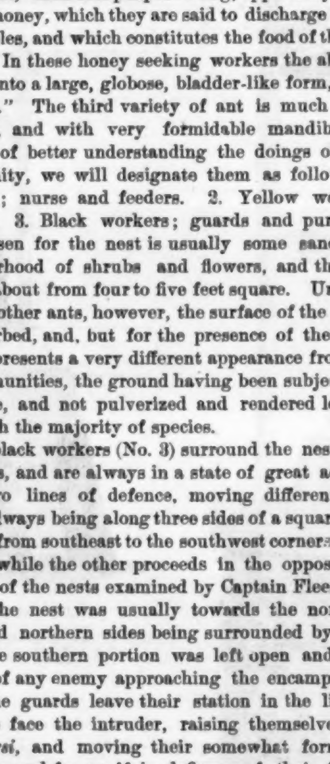
ON THE HONEY-MAKING ANT OF TEXAS AND NEW MEXICO.

BY HENRY EDWARDS, CALIFORNIAN ACADEMY OF SCIENCES.

The natural history of this very curious species (*Myrmecocystus Mexicanus*, Westwood) is so little known that the preservation of every fact connected with its economy becomes a matter of considerable scientific importance, and the following observations, gleaned from Captain W. B. Fleeson of this city, who has recently had an opportunity of studying the ants in their native haunts, may, it is hoped, be not without interest.

The community appears to consist of three distinct kinds of ants, probably of two separated genera, whose offices in the general order of the nest would seem to be entirely apart from each other, and who perform the labor allotted to them without the least encroachment upon the duties of their fellows. The larger number of individuals consists of yellow worker ants of two kinds, one of which, of a pale golden yellow color, about one third of an inch in length, acts as nurses and feeders of the honey-making-kind, who do not quit the interior of the nest, "their sole purpose being, apparently, to elaborate a kind of honey, which they are said to discharge into prepared receptacles, and which constitutes the food of the entire population. In these honey seeking workers the abdomen is distended into a large, globose, bladder-like form, about the size of a pea." The third variety of ant is much larger, black in color, and with very formidable mandibles. For the purpose of better understanding the doings of this strange community, we will designate them as follows: 1. Yellow workers; nurse and feeders. 2. Yellow workers; honey-makers. 3. Black workers; guards and purveyors. The site chosen for the nest is usually some sandy soil in the neighborhood of shrubs and flowers, and the space occupied is about from four to five feet square. Unlike the nests of most other ants, however, the surface of the soil is usually undisturbed, and, but for the presence of the insects themselves, presents a very different appearance from the ordinary communities, the ground having been subjected to no disturbance, and not pulverized and rendered loose as is the case with the majority of species.

The black workers (No. 3) surround the nest as guards or sentinels, and are always in a state of great activity. They form two lines of defence, moving different ways, their march always being along three sides of a square, one column moving from southeast to the southwest corners of the fortification, while the other proceeds in the opposite direction. In most of the nests examined by Captain Fleeson, the direction of the nest was usually towards the north; the east, west, and northern sides being surrounded by the soldiers, while the southern portion was left open and undefended. In case of any enemy approaching the encampment, a number of the guards leave their station in the line and sally forth to face the intruder, raising themselves upon their hind *tarsi*, and moving their somewhat formidable mandibles to and fro, as if in defiance of their foe. Spiders, wasps, beetles, and other insects are, if they come too near to the hive, attacked by them in the most merciless manner, and the dead body of the vanquished is speedily removed from the neighborhood of the nest, the conquerors marching back to resume their places in the line of defence, their



object in the destruction of other insects being the protection of their encampment and not the obtaining of food. While one section of the black workers is thus engaged as sentinels, another and still more numerous division will be found busily employed in entering the quadrangle by a diagonal line bearing northeast, and carrying in their mouths flowers and fragments of aromatic leaves which they deposit in the center of the square. A reference to the accompanying sketch will give a more clear understanding of their course, the dotted line, *a*, representing the path of this latter section, while the mound of flowers and leaves is marked *c*. If the line, *a*, be followed in a southwest direction, it will be found to lead to the trees and shrubs upon which another division of the black workers is settled, engaged in biting off petals and leaves, to be collected and conveyed to the nest by their assistants below. On the west side of the encampment is a hole, marked *d*, leading down to the interior of the nest, which is probably chiefly intended for the introduction of air, as, in case of any individuals carrying their loads into it, they immediately emerge and bear them to the common heap, as if conscious of having been guilty of an error. A smaller hole, near to the southeast corner of the square, is the only other means by which the interior can be reached, and down this aperture, marked *b*, the flowers gathered by the workers are carried along the line, *e*, from the heap in the center of the square, by a number of smaller yellow workers (No. 1) who, with their weaker frames and less developed mouth organs, seem adapted for the gentler office of nurses for the colony within. It is remarkable that no black ant is ever seen upon the line, *e*, and no yellow one ever approaches the line, *a*, each keeping his own separate station and following his given line of duty with a steadfastness which is as wonderful as it is admirable. By removing the soil to a depth of about three feet, and tracing the course of the galleries from the entrance *b* and *d*, a small excavation is reached, which is spread in the form of a spider's web, a network of squares spun by the insects, the squares being about one quarter inch across, and the ends of the web, fastened firmly to the earth of the sides of the hollow space which forms the bottom of the excavation. In each one of the squares, supported by the web, sits one of the honey-making workers (No. 2), apparently in the condition of a prisoner, as it does not appear that these creatures ever quit the nest. Indeed it would be difficult for them to do so, as their abdomens are so swollen out, by the honey which they contain, as to render locomotion a task of difficulty, if not to make it utterly impossible.

The workers (No. 1) provide them with a constant supply of flowers and pollen, which, by process analogous to that of the bee, they convert into honey. The fact that the remainder of the inhabitants feed on the supply thus obtained, though it is surmised, has not been established by actual observation; indeed with reference to many of the habits of these creatures, we are at present left in total ignorance, it being a reasonable supposition that, in insects so remarkable in many of their habits, other interesting facts are yet to be brought to light respecting them. It would be of great value to learn the specific rank of the black workers (No. 3), and to know the sexes of the species forming the community, their season and manner of pairing, and whether the honey-makers are themselves used as food, or if they excrete their saccharine fluid for the benefit of the inhabitants in general, and then proceed to distil more. I regret that at this time I am only able to bring before the notice of the Academy specimens of the honey-makers (No. 2), the other members of the community, except from Captain Fleeson's description, being quite unknown to me. It is, however, my hope that, at a future meeting, I may be enabled to exhibit the other varieties, and to give some more extended information upon this interesting subject. The honey is much sought after by the Mexicans, who not only use it as a delicate article of food, but apply it to bruised and swollen limbs, ascribing to it great healing properties. The species is said to be very abundant in the neighborhood of Santa Fé, New Mexico, in which district the observations of Captain Fleeson were made.

Correspondence.

Hight of the Earth's Atmosphere.

To the Editor of the Scientific American:

In an article on this subject which appears this week in the Scientific American, No. 7, page 101, under the signature of J. E. Hendricks, the celebrated method, first suggested by Kepler, of determining at what hight the atmosphere ceases sensibly to refract light is explained and illustrated. Nothing can be added to the lucid and compact statement of your correspondent.

I propose, however, to suggest a new method of proving the hight of the atmosphere, which is worthy of attention on account of the precision with which such element in the formula can be determined. The average highest temperature under the torrid zone is not to be identified with the mean temperature, which is much lower, being about 82° Fahr., while the highest temperature is 111·5° Fahr.

Let d = density of air on the hydrogen scale, h = hight above base, p = pressure at base, a = coefficient of expansion per 1° Fahr., and t = average highest temperature at equator. We will take one mile of atmosphere, one inch in thickness, on which to make the experiment and test the formula, so as to estimate the hight to which this atmosphere will extend when all the elements have been applied.

$$\underset{t}{115^\circ \text{ Fahr.}} \times \underset{d}{0{\cdot}002036} \times \underset{p}{14{\cdot}75} \times \underset{d}{14{\cdot}416} = \underset{h}{48{\cdot}2478}.$$

Otherwise arranged for our terrestrial atmosphere: $h = tapd =$ 48·2478 miles; $t = \frac{h}{dpa} = 111{\cdot}5^\circ$ Fahr; $a = \frac{h}{dpt} = 0{\cdot}002036$; $d = \frac{h}{tap} = 14{\cdot}416$; $p = \frac{h}{dta} = 14{\cdot}75$ lbs.

Hence, it follows that, if we could take a mile of our atmosphere, or any other pure gas of equal density, and subject it to the temperature, expansion, pressure, and density which are now normal to our atmosphere, it would reach an altitude of 48·2478 miles; and the refraction of twilight confirms this result, for it terminates when the depression of the sun below the horizon amounts to 18°, or, more correctly, 17·8°.

It is easy to deduce from this fact that the atmospheric refractive power ceases when the light exceeds 49 miles; for the angle of incidence and also of refraction being each 9°, we have $9 \times 69{\cdot}5 = 625{\cdot}5$ miles; hence $625{\cdot}5^2 \div 7925$ (earth's diameter) = 49·3 miles, hight of refractive atmosphere. Our new formula gives the result 48·2478 miles with much greater precision, and the angle 17·8° more correctly agrees with observation than 18°.

S. Beswick.

Paterson, N. J.

Pure Air in Cars.

To the Editor of the Scientific American:

The desire of your correspondent F. S. C. for pure air in railroad cars might be gratified by constructing ventilating filters, which should be regulated by the conductor or some other official. The filters should be made of thin layers of raw cotton, kept in place by coarse wire gauze. This, I believe, is the best air filter known. They would require cleaning or removing perhaps once or twice a month.

E. M. G. Jr.

Baltimore, Md.

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 10.

VIENNA, August, 1873.

In the Machinery Hall, the United States is most largely represented in that section of the classification which embraces

WOOD AND METAL WORKING TOOLS,

and we find strongest competition also in this section of the exhibits of the principal foreign countries. The largest and at the same time most noticeable exhibitors of metal working machine tools are Messrs. Sellers & Co., the Browne and Sharpe Manufacturing Company, and Pratt & Whitney, from the United States, Messrs. Sharp, Stewart & Co., Ransome & Co., and two or three other firms from Great Britain, and Ducommun & Co., from France. These firms all exhibit machinery which is remarkable for neatness and effectiveness of design, excellence of material, wonderful accuracy in fitting up, and also for the extent to which tool finishing has been made to excel and to supersede the older practice of finishing by hand. Many other firms, and especially those of European countries, exhibit fine looking tools; but there is usually but little originality to be discovered in their designs, and they present, to the eye and hand of the mechanic accustomed to our American practice, evidence that they have been produced under a system which is now rapidly going out of use in the United States and Great Britain. Half effaced file marks show that the more truly mechanical method of obtaining accurate surfaces by the use of the broadnosed tool and the many other refinements of modern practice are unknown to their builders.

The beautiful planer of Messrs. Sellers & Co., with its odd kinematic combination of the worm and the rack for driving the table, and its neat reversing gear, have long been known to mechanics at home. That at least some of the leading foreign builders have also appreciated it is proven by the appearance, in the exhibits of continental firms, of copies of this machine marked "*système Sellers.*" All other nations, in fact, seem to copy American and British machinery, and rarely to produce original designs. In many cases, the copy is acknowledged, and sometimes the fact is made prominent in the circulars of the copyists, with the evident knowledge that it will render their productions more readily salable. Where attempts have been made to produce original designs, the departures from our standards have very generally been marked by most awkward proportions and frequently by extremely ungraceful shapes.

There is really very little in the exhibition which approaches, in any respect, the machinery exhibited by the several firms named; and those American mechanics who have come here to learn acquire only the knowledge that those from whom they expected to learn are simply following the leaders whose practice is already familiar to every American and British artisan. Nearly all of the machinery of this class in the United States section has been for a long time placarded "sold;" and it is extremely probable that several of the more novel machines have been purchased to serve as models from which to copy. Looking at these fine pieces of mechanism a few days ago, a distinguished member of the jury, whose opinion is probably as much respected as is that of any one of his colleagues, pronounced their builders "the leading constructors of the world, beyond dispute." And as even the leading French firm of Ducommun & Co., and the leading firms of every other nation (not excepting, in some departments, the British), copy their constructions, it may be readily believed that our American mechanics are occupying a most creditable position. The Sellers planer, the Browne & Sharpe universal milling machine, and the Pratt & Whitney screw cutter seem to have been most copied.

In the manufacture of metal working machine tools, the practice in America and in Great Britain is generally very similar. Strong heavy frames, the absence of all moldings and other kinds of ornamentation which were so much in vogue a few years ago, great accuracy of workmanship, and the least possible use of hand tools (either in "assembling" or in finishing) seem the prominent characteristics on both sides of the Atlantic.

If a difference is remarked at all, it is usually that British builders put in more metal and build rather more substantial machines, while the Americans excel in the ingenuity and skill which they display in matters of detail. It may certainly be questioned whether the former do not err in building machinery with a view to such extreme endurance. Improvements take place so rapidly that these very long-lived machines must frequently be superseded long before they are worn out; and when thrown into the scrap heap, they still represent considerable capital; and the machine which is set aside by the progress of improvement, at a time when it has more nearly reached the limit of its endurance, is the better machine of the two. To determine precisely where to find the proper limit is certainly a problem; but it can hardly be doubted that our best machinery is capable, usually, of doing good work for a length of time which will probably exceed that limit. It may be added also that, where capital is as valuable as it is in the United States and in all new countries, a good business policy dictates that a smaller proportion be expended in first cost and a greater in maintenance than in countries like Great Britain, where capital is plentiful and cheap

The remarks which have been made in regard to metal working machinery at the Vienna exhibition will also apply to wood working machines. Here, also, the United States and Great Britain have been the leaders and the originators, and continental builders have copied from them. In this department, the American mechanic can probably claim more credit for originality than the British; but our transatlantic competitors, while adopting American machines, have sometimes improved upon them, and they have generally built them very much more substantially. This contrast is much more marked here than in the preceding class of machines, and attracts considerable attention. The British machines are also all painted a plain lead color, while those from the United States are often elaborately painted in "loud" colors. While the latter colors offend the eye of our friends on this side of the water, they also render more apparent the difference in strength and simplicity of frames. A comparison of the work done by the two is not at all to the disadvantage of the American; and a comparison of prices, making allowance for the difference in the cost of stock and of labor which is charged against each, is decidedly in our favor.

In the French section, the

BAND SAW

is exhibited by Perin, its earliest successful constructor; but the leading English firm of Ransome & Co. copy the beautiful machine of Richards, London & Kelley of Philadelphia. We consequently find exhibited, in the United States and British sections, a pair of precisely similar machines. The most thoroughly well contrived band saw in the exhibition is, perhaps, that of Mr. B. D. Whitney, the inventor of the pail-making machinery which has so greatly interested visitors, particularly foreigners, who are not generally familiar with machinery of special application. In this band saw, the arrangement of spindle bearings and of springs, and the contrivance for taking the back pressure of the blade, are exceedingly well planned. Perin uses neither springs nor weights, but the British builders use weights very generally for taking up the stretch of the blade as it warms up and expands while running. A well arranged spring, in consequence of its greater compactness and the absence of motion, is considered by our mechanics to be preferable; but the weight is almost invariably used in Britain, and Perin insists that, when a saw is hot enough to slip on its pulleys, it is time to stop it, and thus explains his omission of that detail. The French exhibit some beautiful specimens of band saw blades. Of

WOOD PLANING, MOLDING, MORTISING, AND OTHER MACHINES,

the largest and finest collections are found in the British section. Rogers & Co., Fay & Co., and Witherby, Rugg & Richardson, who are the exhibitors of the excellent tools in the United States section, while equaling in quality, do not all taken together equal in magnitude the exhibits of either of several British and continental builders. The patterns used throughout are, however, generally those which, having become standard in the United States, have spread abroad. The continental builders exhibit nothing original; but a few firms make very creditable copies. Some of the Swiss work is excellent, and the German exhibits of Zimmermann and of Schmaltz, with the fine display of Carl Pfaff from Austria, are also well worthy of notice. The latter is "*ausser Concurs,*" its exhibitor being a member of the jury.

The British builders seem to find a market for what they call a

COMBINATION MACHINE,

and nearly every exhibit contains an example of this *multum in parvo.* A planing and a molding machine, a circular saw, a mortising and a tenoning machine are all placed on one compact but exceedingly complicated frame. Its compactness and the somewhat lower cost, as compared with a similar collection of detached machines, are probably the reason of its success in the market. It seems improbable, however, that it can be well adapted for use in establishments where much work is done. Separate tools, with ample space around them, with more accessible parts, and which may be used independently, are indispensable for such places. These combination tools seem well adapted for pattern shops and for small carpentering establishments.

The French section contains one wood planer which is particularly interesting and novel. The knives are slender strips of steel which are wound spirally in grooves about a metal cylinder revolving on a horizontal axis above the table of the machine. The knives are thus so contrived as to make a "draw" cut, and do their work rapidly and beautifully. The machine would, however, probably prove far less efficient were it not for the neat method adopted of setting and sharpening these spiral blades. Directly above the cylinder carrying the knives, and upon a parallel axis, revolves an emery grinding wheel, which can be very readily set properly; and being then put into rapid motion, it is moved from side to side by a slow feed while the knives are slowly revolved beneath it. The blades are thus sharpened in place and are given perfectly keen, straight and properly set cutting edges. The blades themselves are simple in form, very light, and are easily made by cutting them out of thin steel plate. This seems a most excellent tool. It does not require the fixed scraping blade which is now so generally adopted for making the smooth finishing cut on the ordinary tool.

In the manufacturing of

MACHINE TOOLS OF ALL KINDS,

the ideas which have been the secret of the success of our largest builders,—that of making them in large quantities from carefully considered and standard designs, and of doing as much work as possible by means of machines, specially constructed for the accurate production of each important detail; in fact, of manufacturing, rather than simply making (and of which the sewing machine and the gun-making trades are the most perfect illustrations),—are at last becoming appreciated and are being adopted on this side of the Atlantic, manifestly to the great advantage of both producers and consumers.

There is, however, one way in which it tells strongly against them where they compete with our own people. Lacking that wonderful ingenuity and originality which Nature and our

PATENT SYSTEM

have conferred upon the American mechanic, their standard designs are always a little less perfect than our own standards. They are what were standards with our builders at an earlier date, and thus it happened that, while always closely following, they never quite overtake. The modern system of manufacturing renders change of design a far more important matter than before, and the caution which is naturally induced by the expense of changing designs tends to keep them farther behind. A liberalization of patent codes and the gradual training of the workmen of Europe to a knowledge of the importance of good workmanship and of the methods of securing it will, at a time which we may hope is not very far distant, do much toward remedying all this, and toward the improvement of the condition of the people in Europe. We draw some of our best material from among them, and it seems sufficiently evident that not upon Nature but upon man's own imperfect political systems lies the responsibility of the existing unsatisfactory conditions of manufactures in Europe. R. H. T.

Arctic Regions.

The 80th of the series of papers on the progress of geographical research in the polar regions, published by Dr. Petermann in his *Mittheilungen,* contains a *résumé* of what is known from all sources respecting the American north polar expedition under the late Captain Hall, and is accompanied by an elaborate map, in which the results of this expedition, as far as these are known, have been critically compiled, together with *data* of the former voyagers, Kane and Hayes. The story of the Polaris voyage is already well known in England, and no fresh tidings of the ship, which wintered, 1872-73, with the ten remaining members of her company on the coast of Northumberland Island, in lat. 77° 20′ N. in Baffin Bay, have reached us since autumn of last year. Two vessels, however, generously sent by the American Government, have for some time been on their way northward to find and succor the Polaris crew.

In his remarks on the general results of this voyage, Dr. Petermann draws a remarkable contrast between the advances made by the various expeditions which have been undertaken in steam vessels, and by those in which sledge traveling has been tried; maintaining that, since Hall's expedition had shown that there is no such thing as a permanent covering of ice in this branch of the Polar Sea, sledge traveling is little to be depended on, and steamships should alone be employed. The discovery of drift wood on the shores of Hall Land (the east coast of Robeson Strait, between 81° and 82° N.) makes it not improbable, Dr. Petermann believes, that the land breaks up here into an archipelago of islands, or at least that there is communication by which Asiatic drift wood finds its way hither; and on the other hand the presence of numerous musk oxen in these regions makes it very probable that Hall Land is in uninterrupted connection with the coast of East Greenland in lat. 77° N., explored by the second German expedition of 1870-71.—*Academy.*

PRODUCTION OF VEGETABLE TISSUE.—It has been ascertained by Professor E. N. Horsford that an ethereal extract of green leaves, which has been separated by hydrogen chloride into two layers, a yellow and a blue layer, contains in both portions phosphoric acid, iron, potassium and calcium. He has further observed that a mixture of sodium phosphate and iron protosulphate in presence of water is able both in light and darkness to reduce carbonic acid to carbonic oxide. From these observations it appears probable that the formation of a solution of a phosphate of iron protoxide may be a preliminary stage towards the production of vegetable tissue from the element of carbonic acid, water and ammonia. Formic acid, it is well known, may be formed by the direct combination of carbonic oxide and water.

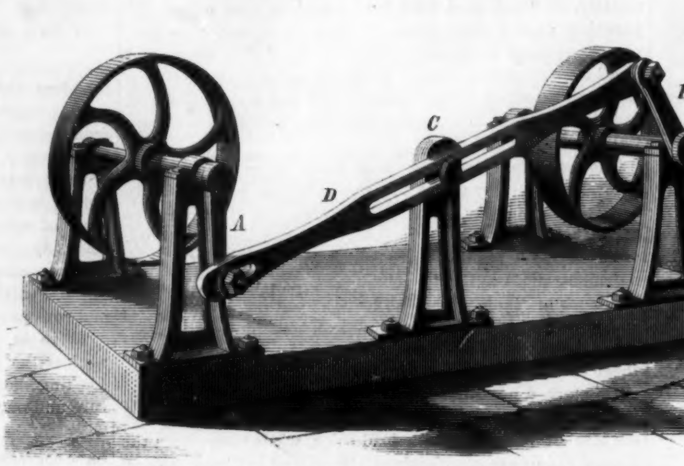
THE caststeel works of Mr. Krupp at Essen, Prussia, now cover an area of 1,000 acres—larger than the Central Park, New York city. Nearly 18,000 men are employed in connection with the works. The area under roof is 200 acres.

DEVICE FOR TRANSFERRING MOTION.

By means of the invention represented in the annexed engraving, an efficient substitute, it is claimed, for cog wheels is provided, in cases where it is desired to transmit motion from one shaft to another, both working with the same velocity. The device is stated to be cheaper and to operate with less loss of power than the cog wheel gearing; and also, to be able to transmit positive power for any distance, from one to twenty feet, and thus is of especial use in cases where belts would slip.

A and B are crank arms of two shafts, between and in a line with which is a fixed standard, C. The latter at its upper end has a stud or pin. D is the connecting bar, slotted longitudinally along its middle part for connection with the stud on the standard, as shown. One end of this bar is pivoted to crank arm, B, and the other extremity is provided with a short slot by which it is connected to the pin of the opposite crank.

When one shaft is set in motion, power will be communicated by the lever, U, to the other, which will rotate in an opposite direction. The inventor believes that, by connecting together a number of these devices (attaching a third shaft to the second by another lever, and similarly a fourth to the third and so on), power may be transmitted over considerable distances. Patented July 15, 1873, by Mr. William H. Benson, of Waynesboro, Augusta county, Virginia, who may be addressed for further particulars.



BENSON'S DEVICE FOR TRANSFERRING MOTION.

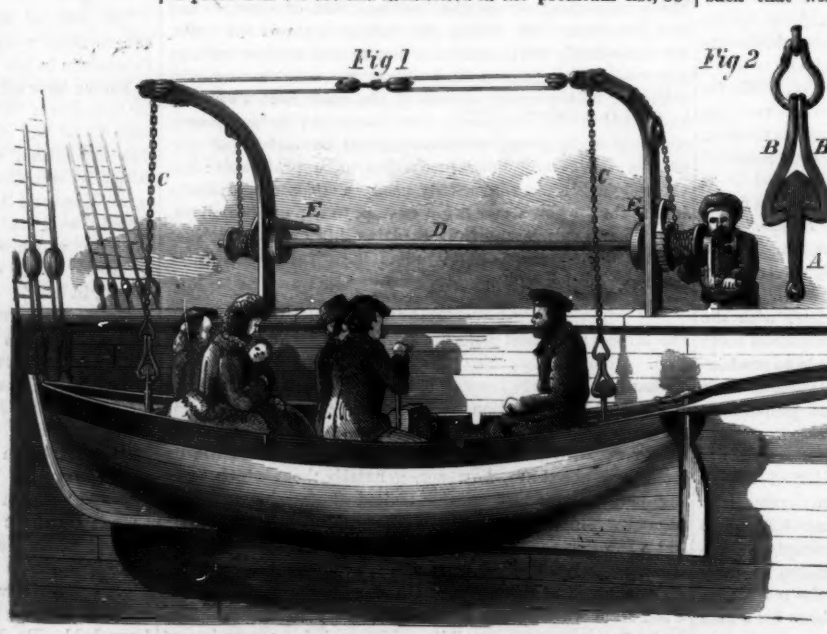
AUTOMATIC BOAT DETACHING APPARATUS.

Our engraving illustrates a new form of boat lowering and detaching device, by means of which, it is claimed, the boat can be lowered quickly, and safely and automatically set adrift as soon as it floats upon the water.

A A are bolts secured to the boat near the bow and stern, having, on the under side of their heads, V shaped recesses extending upwards. B B are slip hooks fastened, by a ring or other suitable means, to the ends of the chains, C. The lower ends of the hooks are turned upward and fit, as shown in the detail figure on the left of the illustration, into the recesses in the bolt heads. By this means, the boat is suspended from the davits by the chains, C. The latter are led inboard over suitable sheaves and fair leaders to drums on the shaft, D. Ratchet wheels and cranks are arranged in connection with the shaft, the pawls of the former holding the boat in position after it is hoisted by means of the usual tackles on the davit heads.

When the boat is to be lowered quickly, the falls are unhooked, and its weight allowed to hang by the chains, C. The pawls are then thrown from the ratchet wheels, and the shaft, D, is allowed to revolve by the chain unwinding, as the boat descends. The rapidity of the lowering is regulated by the brakes, G, pressed down by their levers against pulleys on the shaft. As soon, however, as the boat reaches the water, the chain slackening allows the hooks, B, to fall below and clear themselves at once from the recesses in A, leaving the boat free from any connection with the apparatus. It should be noted that the V shaped grooves and hook ends are of peculiar form, that is, they are angular and yet turn upward, so that, when once held together by the suspended weight of the boat, vertical, as well as transverse and lateral, displacement of the parts is prevented. It is claimed that it is impossible to disengage the boat until it is fully afloat, and that no matter how much the craft may rock, sway, or swing against the ship's side in descending.

Patented April 29, 1873. For further particulars address the inventor, Mr. Charles A. Enell, 307 Walnut street, Philadelphia, Pa.



ENELL'S AUTOMATIC BOAT DETACHING APPARATUS.

THE INDIANA STATE EXPOSITION.

Indianapolis, during the coming fall, is to be the location of an exposition of the industries and manufactures of the State of Indiana. Whether or not the fair, in comparison with the similar shows to be held in St. Louis, Louisville, Chicago, Kansas City, and other points, will realize the anticipations of its projectors in being the finest exhibition in the Western States, it all events deserves the credit of being organized in a thorough and substantial manner, and after a system which, it seems to us, might be profitably followed in all future local displays. A committee representing the State conferred with another delegation from the capital city, and the joint body decided on the amount necessary to secure the State from any loss. This sum, fixed at $100,000, was guaranteed by the leading firms and individual citizens of Indianapolis; and, thus founded on a sure pecuniary basis, the preparations for the enterprise were begun; committees were sent to other cities to obtain information regarding cost and construction of buildings, and then plans were submitted and fixed upon. The State fair grounds were ready at hand, so that no land had to be purchased. The buildings are now completed, and they afford a grand aggregate of over four hundred thousand square feet of exhibiting space. There is to be a fine collection of paintings in the art department; and a marked feature of the exposition will be a museum of natural history, archæology, mineralogy, etc. The central portion of the buildings is a substantial brick structure, two stories of 20 feet each in hight, 308 feet inl ength, and 150 feet in breadth. The edifices on the east and west are in the form of a cross, and are 200 × 200 feet.

Liberal premiums are offered to the exhibitors in the horticultural department. There are two lists, one each, respectively, for amateurs and professionals, which include almost every thing in the line of fruits, flowers, and plants grown in Indiana. James Vick, the Rochester florist, offers prizes to the amount of $150 on flowers grown from seed purchased of him.

In the mechanical department, every facility will be afforded for a thorough and complete determination of the merits of the articles contributed. All machinery will be in motion. Ample space and power will be furnished, free of charge. The driving engines will be in operation one week or more previous to the opening of the exposition, so that machinery may be adjusted and in proper running order on opening day. The main line of shafting will be speeded at 200 revolutions per minute. Pulleys will be 20 and 24 inches in diameter. Other sizes of pulleys will be put on the shafting, if furnished by exhibitors three weeks previous to the opening of the exposition.

Twenty thousand dollars, payable in cash, gold and silver medals, and diplomas of new and elegant design, are offered in premiums for articles mentioned in the premium list, obtainable on application. Saw mills, reapers, mowers, threshers, separators, and grain drills will receive no award, for the reason that it is not practicable to have such thorough tests and examination of their merits as will be just to the exhibitor. The board will, however, provide every necessary facility for their display, and propose, as an inducement to manufacturers and dealers in these articles, to appoint an examining committee, composed of members of the board, who will give each article of this kind such consideration as will enable them to report their respective merits for publication in the annual reports. We also learn that, by special request, no premiums will be offered for fire and burglar-proof safes, bank and safe locks, sewing machines and musical instruments, although ample provisions will be made for their exhibition.

The fair opens on September 10, and closes on October 10.

To Purify Tallow.

In order to obtain tallow quite free from smell, and to preserve it for a long time without becoming rancid, the following simple process, says the *Chemical Review*, may be used. The fresh tallow is melted in boiling water, and when completely dissolved, and consequently hot, it is passed through a linen filter—it is then boiled along with the water and carefully skimmed—then rendered solid by cooling and washed with water, and lastly separated from it carefully by pressure. It may be melted at a moderate heat and preserved in earthen vessels, covered with a bladder, paper, or good closing lid. If the linen filter is not thick enough to keep other ingredients from passing through besides the liquid tallow and water, it is better to repeat the filtration. Tallow thus obtained may be used for ordinary food, for pomades by the addition of pure olive oil, for salves and plasters, by the addition of white wax, and may be kept well preserved for a time, as free from smell as when first prepared.

Asbestos Piston Packing.

From an address, by J. G. Gibbon, before the London Association of Foreman Engineers, it appears that the name of this indestructible compound is derived from the Greek word *asbestos*, which, translated, literally means unburnable—a title which is justly earned by this extraordinary substance. Asbestos is a mineral; it is found in nearly every part of the world, and occurs in distinct veins and seams, usually in the serpentine formation of rocks. In order to procure it, it is necessary to mine in regular form, and to work the seams by blasting and tunneling. The manufacture of asbestos steam packing is at once a simple and beautiful process. The raw material is brought to the manufactory in considerable quantities from different parts of the world. It comes in sacks, and resembles most closely chips and blocks of wood, although of a beautifully white color. The fragments are picked apart and reduced to a fiberous condition like jute, or flax, or cotton. The material once properly opened up, it is, by means of simple and ingenious machinery, formed into packing of the usual market sizes. The machines themselves are as easily attended to as are weaving looms. As to what has been really accomplished by this packing, I have no direct evidence to offer, but from the sample I have here I think it does not seem to possess a good fiber; and that when the flaxen twine which binds it is cut, it will become very much like cotton waste. I am inclined to think, therefore, that when the glands get heated and the flaxen twine is cut through, it will blow out like charred flax, and have no elasticity. However, I am here to be corrected in my opinion, if I form a wrong one, by those who can offer contradictory evidence. A large screw steamer lying in the West London Docks has just replaced the whole of its packing by asbestos.

Uncomfortable Car Seats.

Why do not the makers of street cars contrive a seat back that will be comfortable? Do their customers (preferring "short fares") order the cars to be made so as to discourage long riding? It would seem so, unless the painful curves of the seats are specially contrived to accommodate the humps of wirework and newspapers, so much affected by the women folk. Certain it is that the human form divine, male or female, has no curves to correspond with those set for the weary traveler to lean against. Only by making a hoop of himself can any normally shaped human being get his spine to touch the seat back where it ought to find support.

A caustic Briton declares it to be a characteristic of the genuine American that he always wants to sit on the small of his back. To judge from the ordinary structure of car seats, one would think his sole desire to be to hang himself up by the shoulder blades, the only certain line of contact between the sitter's back and the seats invariably crossing that portion of the body. Below that line, you can usually stuff a book or a bundle, or even a small satchel, with ease and comfort.

In many cases the original perversity of the seat back is hightened by fastening a ridge of wood so as to increase the gap between the hollow of the sitter's back and the opposite curve of the seat. If the same board were placed six inches lower down, it would make some approach toward affording the passengers a back rest where it is most needed.

The Compass in Iron Vessels.

Captain R. B. Forbes, of Boston, Mass., states that the compass in iron ships is specially affected in certain localities on the coast of Nova Scotia, which accounts for the loss of steamers in that region. He further says that, in spite of corrections, applied in England, whereby iron ships may be safely navigated in a given course approximately west-southwest and east-north-east, when they come to head more to the north or south by several points on the American coast, their corrections, good on the coast of England, are valueless in some ships. It is well known that the heeling of the iron ship, the rolling, the pitching, the concussion of the waves, have an important effect upon the compass—hence, nothing but constant observations of the sun at noon and the north star can insure a correct course.

W. P. H. suggests placing a box in the corner of a room for the purpose of destroying a rat or mouse. Let there be room enough for the vermin to get behind the box, and a little pressure will crush the offender against the wall.

Journalism.

There are three papers published in this country, which, taken together, are adapted to furnish a liberal education to any person who will read them conscientiously and intelligently. These are the New York *Tribune*, the *Nation*, and The SCIENTIFIC AMERICAN. The first is distinguished as the very Bayard of newspapers—without fear and above reproach. Its news is accurate, comprehensive, well arranged; and it is written in excellent English. The *Nation* we admire as a literary journal. Though its political articles are admirable specimens of candid and able writing, its reviews of books are more characteristic and distinctive. The SCIENTIFIC AMERICAN is least known of the three papers mentioned, for the reason that it is popularly supposed to be designed for specialists. Nothing could be further from the truth. In the same sense that the *Tribune* is only a newspaper and the *Nation* only a literary journal, the SCIENTIFIC AMERICAN is only scientific. It is worth, to the man of common school education, twice over more than any rival journal in the United States, and it will teach no man to despise the English language, or to regard less the pursuit of knowledge—for its own sake, and for what it will bring. What we have written is wholly unsolicited testimony to the worth of three papers that come to this office; it is given from the purest motives, and without the slightest idea that it will be of service to anybody, except those persons whom it may induce to subscribe for one or all of three excellent journals.—*Interior.*

THE TURKISH TREASURE PAVILION AT VIENNA.

Among the one hundred and forty special buildings, in addition to the main exhibition edifice, pertaining to the Vienna World's Fair is the Treasure Pavilion of the Sultan of Turkey, or King of the Ottomans. The pavilion is in the form of an oriental kiosk. The domed within ceiling is painted in arabesques, and pendant from it are five large golden walls. Here may be read the history of the Sublime Porte from the days of the conqueror of Byzantium, Mahmoud II., to the present Padishah, Abd-ul-Aziz. The golden throne of Nadr-Shah is here, which was renowned in the East before the peacock throne of the Great Mogul at Delhi was dreamed of. It is marvelous in its workmanship, large enough for a coach, and weighs four and a half hundredweight. It is enameled in celadon, green and crimson, and its patterns of arabesquerie are in rubies, emeralds and pearls. Above it hang the turban and armor of Sultan Murad, heavy with gold and gleaming with jewels. Near it are the horse caparisons of Selim III., with the heavy Mameluke stirrups and Arab bit of solid gold, encrusted with diamonds. Scabbards, where nothing but diamonds can be seen; cinctures of diamonds; bowls of China porcelain, their patterns marked out in gold and reset with rubies; clocks encased in diamonds and glistening with crescent moons and stars; hookahs with golden bowls, and chibouques whose amber mouth pieces are encircled with rings of diamonds, gleam and glisten everywhere.

The value of the Turkish treasures contained in the pavilion is estimated at $27,500,000.

Finishing Stereoscopic Transparencies.

The method adopted by many, of fitting up transparent slides for the stereoscope by mounting them with a plate of ground glass is very far being a good one. The coarse granularity present in a picture when in juxtaposition with ground glass is totally subversive of the fine details.

Thin paper has been tried as a backing for stereoscopic transparencies, but no sample that we have seen is free from objection. It is true that when it is used the granular appearance peculiar to ground glass is no longer present; but paper has a kind of texture and unevenness peculiar to itself, which is very far from being pleasant; and when such a quality of paper is used as shall be homogeneous, it possesses so much "body" as to seriously interfere with the transmission of light.

The requirements of a body that shall act in the most perfect manner as a backing for stereoscopic slides are homogeneity, a requisite degree of translucency, and facility of application. The great manufacturers of transparencies in France thought they had provided a successful rival to ground glass by the introduction of "ground glass varnish," that is, a varnish which, instead of drying bright and transparent, dries dead and, therefore, more or less granular. A varnish composed of wax dissolved in chloroform is a type of this class of varnish. But none of these ground glass varnishes answer well for the purpose in question; while, however, they are quite as good as, in most instances better than, ground glass, they are still inferior to what they should be. A backing of a far superior kind to any of those now in general use may be made by means of white pigment, emulsified with one or other of several substances that we shall name presently.

Carbonate of lead forms a good pigment for the purpose. It is known as white lead, and flake white. The carbonate of commerce usually contains a large proportion of sulphate of barytes, which, however, does not affect it for this purpose. Some samples of carbonate are more opaque than others. It may be made of a fine translucent character by precipitating a solution of either acetate or nitrate of lead by a solution of carbonate of soda, by which carbonate of lead is precipitated and acetate or nitrate of soda left in the solution. When this is washed—at first with water, and then with methylated spirit—and is added to plain collodion, an emulsion is obtained which, when poured upon a plate of glass, forms a layer of great smoothness and uniformity, and as free from apparent grain or texture as a plate of opal glass.

Another fine white, known as "miniature painters' white," is obtained by adding dilute sulphuric acid to an acetic or nitric solution of litharge, and washing the white precipitate. There is a fine and permanent white known as "alum white," which makes a beautiful emulsion with collodion. It is known by some as "Baumé's white," and no difficulty ought to be experienced in obtaining it under one or other of these designations. Ordinary Spanish white we have not found to answer well; but pearl white, sometimes called "Fard's Spanish white," makes a useful pigment for our purpose. It is the trisnitrate of bismuth, and in he favourite pigment used by ladies who do not feel satisfied with the degree of whiteness imparted by Nature to their complexions.

When one of these pigments is mixed with collodion and is applied either to the picture itself (although, without an intermediate layer of gum or india rubber, this cannot be done) or the face of the protecting glass, next to the picture, the transparency will then have a charm it never previously possessed. The most delicate tints will be seen with even greater distinctness than if a backing of opal glass were employed; and the operation can be conducted with great celerity and at a trivial cost, for the quality of the collodion need not be taken into consideration.—*British Journal of Photography.*

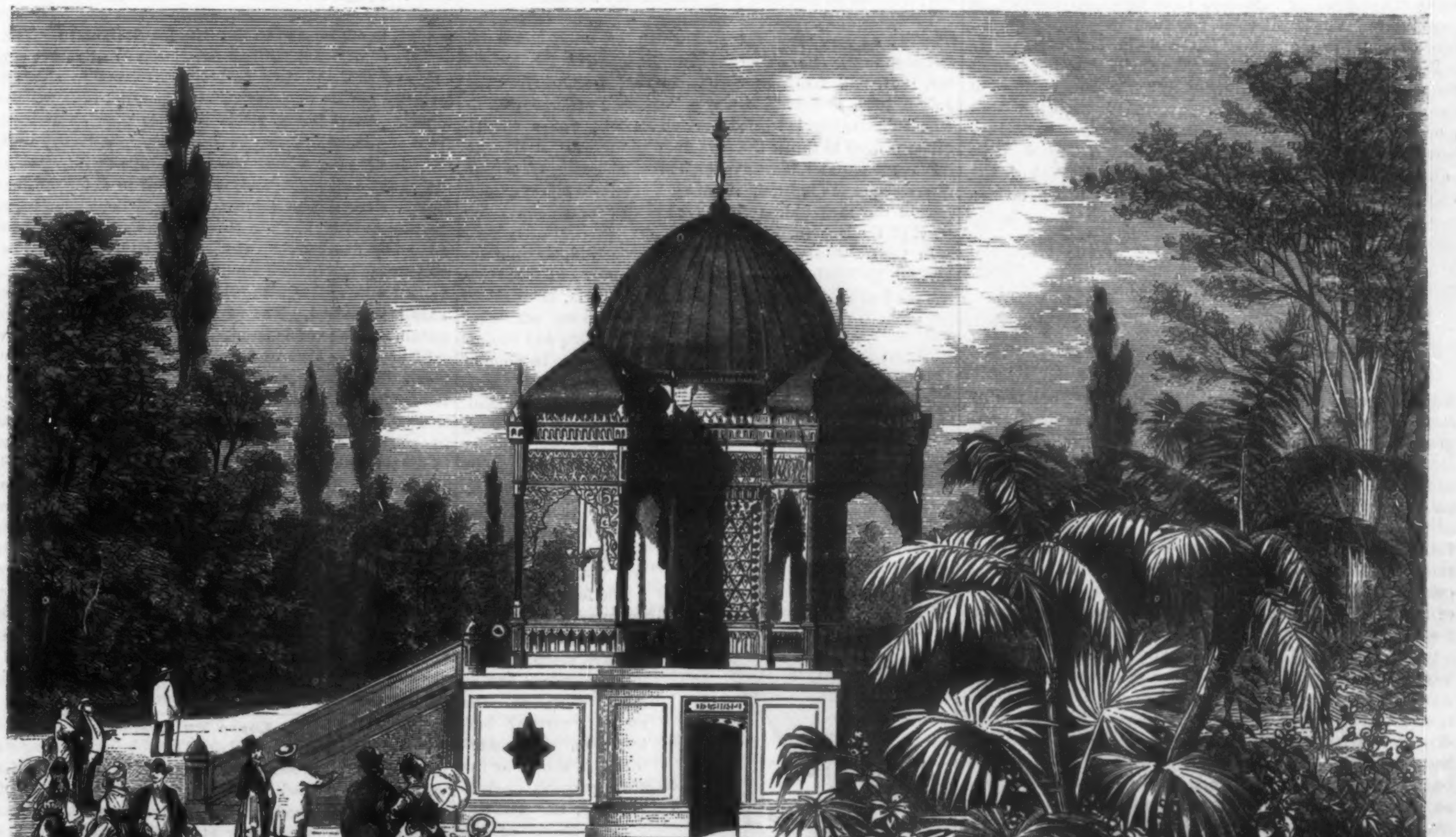
Boiler Explosions.

R. S. H. writes to deny the possibility of the formation of an explosive gas in a steam boiler, and states his belief that the small quantity of water injected at a time, by a feed pump, could never cause an explosion, even if some of the plates were red hot. Further, a red heat would, he says, assuredly start the seams and cause leaks so as to extinguish the fire before water could come in contact with the plates. He asserts that high pressures are much more dangerous than people generally believe, even if the boilers are unusually strong; and he cites, as an instance of the manner in which safety valves are overloaded, a case on the Union Pacific Railway, in which the engineer tied down the valve lever of a new Baldwin ten wheeled engine; in a few seconds the boiler burst, and six inch axles were torn in two by the explosion.

Ship Canal through Syria.

T. L. F. writes to point out the possibility of constructing a ship canal along the valley of the Jordan, the advantage in the route being the low level, which is beneath that of the Mediterranean. There is no doubt or the possibility of such a work, but its magnitude, and the fact that the Suez canal is already in operation between the two seas, will probably deter capitalists from aiding the scheme.

CORK JACKETS FOR STEAM BOILERS.—M. Chevallier, a French engineer, has adopted cork for the jacketing of boilers and other parts of machinery. Cork is known to be an excellent non-conductor of heat, and these cork jackets are said to diminish the outward radiation by 15° C. The cork is cut in the form of staves, and these are united together by tongues, as in the case of flooring boards, so that the lines of junction are protected, while the cork staves are easily removed when the necessity occurs. Portions of one of these jackets, which had been on a boiler at work for fifteen months, were exhibited the other day at a meeting of the Paris Society for the Encouragement of the Arts, etc., and were not found to have been in any way affected by the heat of the boiler.



THE TURKISH TREASURE PAVILION AT THE VIENNA EXPOSITION.

THE MAGIC LANTERN AS A MEANS OF DEMONSTRATION.

BY HENRY MORTON, PH D.

PART 2.

We have thus far considered the condensers chiefly in reference to the first portion of their office, namely, that of collectors of light from the radiating source. We will now, however, pass to some of those general considerations which may claim our attention when we look at the condensers in their relation to the objects and object glasses or objectives.

RELATIONS OF CONDENSERS AND OBJECTIVES.

To make the subject entirely clear, we should revert for a moment to the general properties of lenses as producers of images from luminous objects. Let C D (Fig. 6) be such an object, as a candle flame, placed a little beyond the principal focus of the lens, A B. Then all rays emanating from any point (as, for example, C) will be collected at a corresponding point, E, and will there form a point of the image, E F. This will be true for each point of the flame, C D, and consequently a perfect image of this flame will be formed at E F. The perfection of this image would evidently be unaffected by any possible irregularity in the rays from C D. Thus, if very few rays went in the direction, C A, and nearly all followed the line, C B, the point of the image, at E, would be the same as if all the rays reaching it came through C A*.

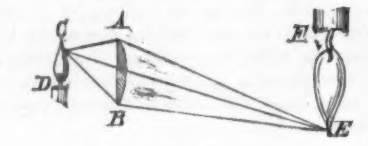


FIG. 6.

If, now, in place of the candle flame, we suppose a luminous surface to exist, at C D, an image of this surface will be produced at E F, and will be clear and uniform, provided only that the surface, C D, is uniform in emitting equal amounts of light from its different points, no matter how irregular may be the directions of the rays leaving these points, always providing that they enter the lens, A B.

Thus, suppose that, in the luminous surface, A C B (Fig. 7), rays from A were so emitted that above they were closely packed, while below they were thinly scattered; rays from B were emitted in an opposite order, and from C were close packed in the center and scattered on the outside; yet, if an equal number of rays or quantity of light came from each element, the image of each would be equally bright: and if this were true of each point or element of the surface, the image would show an uniform field of light, no matter how irregular the emission of the various points might be as regards the direction of the rays. If, however, one point emitted or furnished more rays than another, or gave light of a different color, any such irregularity or difference would be represented faithfully in the image.

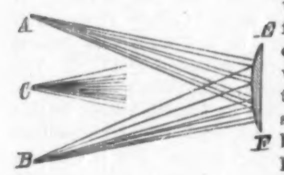


FIG. 7.

We will now apply these general principles to the case of the magic lantern. Let A B (Fig. 8) be the front element of the condenser, through which rays are passing into the object glass, C D, which is at such a distance that it makes on the screen, E F, an image of any point in A B. Then, if an equal amount of light is coming through each point of A B, an uniform white disk will appear on the screen, E F, no matter how irregular (in the sense above described) are the directions of the rays. The irregularities will, in fact, be very great, for besides such as are due to the aberrations of the condensers, these lenses will themselves be tending to form somewhere an image of the source of light. In fact, such an image would be formed, at O, about the principal focus of the lens, A B, if the objective, C D, were removed. This formation of an image at O involves a great irregularity of the distribution of light between O and A B, indeed, the existences of imperfect images of the source of light. But of all this, the objective, C D, takes no account, and simply forms, at E F, an image of the distribution of light which actually exists at A B. Suppose now, however, that C D were removed to C′ D′. Its focus remaining as before, it would clearly form an image, not of the surface, A B, which is now beyond its reach, but of a surface, A′ B′, at its proper distance. But it evidently would by no means follow that, because the light was evenly distributed at A B, it must also be so at A′ B′. On the contrary we have already seen that, as we advance from A B, the distribution of the light will become more and more irregular; and it will be an image of this irregularly luminous surface which will be thrown on the screen at E F.

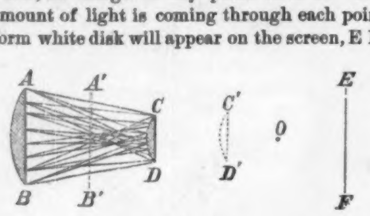


FIG. 8.

This shows us that, to secure a clear and even field of light on the screen, we must, in the first place, have such a combination of lenses in the condenser as will secure an even distribution of light at the outer surface of the last lens; and, secondly, that the objective must be so placed that it will, as we say, "focus" on this surface, that is, have this outer surface of the condenser and the screen as conjugate foci. To fulfil this last conclusion it is evidently necessary that the object (such as the picture to be shown, or the like) should be placed close to the front of the condenser, since it, as well as this surface, must be in the focus of the lens, that is, the conjugate focus with the screen. It is for this reason that the plan, sometimes proposed, of using a small picture with large condensers, by bringing the picture forward on the cone of rays to some point where they will just embrace it, fails of a satisfactory effect. The field of light is more or less discolored and unequal; and though, by cutting off its margin, we can improve this, it is at best but unsatisfactory as compared with the effect obtained with the same light and smaller condensers. The same explanation also shows us the advantage of that divisibility of the condenser, which we have before mentioned, into the collecting lens or lenses, by which diverging rays are brought into a parallel bundle, and of the condenser proper by which they are concentrated into the objective. Thus, for example, suppose that we desire to polarize the light, by reflection, from a bundle of glass plates. If the condensers are inseparable, the object must be placed beyond the reflecting surface, and therefore very far from the surface of the condenser, and thus involve an uneven field of light, not to mention imperfect polarization, in consequence of the difference in angle of various parts of the cone of light.

If, however, we can separate the condensers from the collectors, and introduce the reflecting surface between, we then have the rays all parallel, when reflected hence at the same angle and equally polarized, and the object in contact with the front surface of the condenser (see Fig. 9). Again, if we desire to exhibit objects that must be kept in a horizontal position, such as waves in a tank of water and the like, this separation of the condensers affords a ready means of accomplishing it in a most satisfactory manner. This modification of the instrument is, however, so important an appliance to the magic lantern, when used as a means of demonstration, that it deserves some more extended notice.

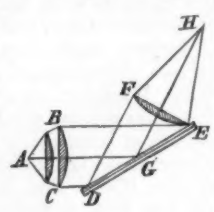


FIG. 9.

THE VERTICAL LANTERN.

This instrument involves such natural and simple applications of appliances, familiar to every one using such apparatus, that, as we might naturally expect, in some form or other it has been independently devised by several persons. Thus such an attachment to his ordinary lantern was made by Duboscq, at least as early as 1868, as the present writer is informed by Dr. H. Schellen, the renowned author of "Spectrum Analysis," though this manufacturer does not seem to have thought it worth while to describe it until very recently. From the imperfect arrangement of the condensers, it also does not yield very satisfactory results.

Professor J. P. Cooke, of Cambridge, Mass., used a vertical lantern at a very early date, of which he published a description in the *Journal of the Franklin Institute* for December, 1871, Vol. LXII. page 411. In the *Chemical News* for July 8, 1869, is described a very imperfect arrangement in which the lantern is turned over on its back, and a square prism is used to throw the rays upon the screen. Beside the inconvenience and danger to the lenses, of having them thus directly over the light, the square prism fails to reflect a large part of the rays unless the screen is very much above the level of the lantern.

In the *Chemical News* for February 25, 1870, there is described, by Edwin Smith, M. A., an arrangement for showing the motions of a galvanometer on a screen, identical in all respects with that of Duboscq and Professor Cooke. In none of these were the conditions required by theory, as above explained, fully provided for, and the action was consequently so far unsatisfactory that the instrument was never brought into any general use.

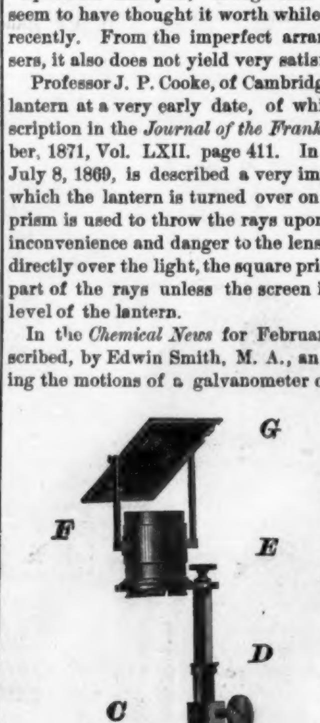


FIG. 10.

The form devised by the present writer, in 1871, which seems first to have made its way into general use and to have conferred the name "vertical lantern" on the instrument, is shown in the accompanying engraving, Fig. 10. The collecting lenses of the condensers are attached to the ordinary lantern box, and are omitted in the figure; and from them a bundle of parallel rays falls on the mirror of silvered glass, A B, and is reflected upward to the condenser proper, placed horizontally at C. Passing through this it meets the object, a tank of water or the like, resting or supported immediately above, and then traversing the objective, E F, is, by the mirror of silvered glass, F G, thrown upon the screen.

Mr. George Wale, of Hoboken, N. J., by whom this instrument was first made for the present writer, has devised a very pretty arrangement by which all the advantages of the vertical lantern can be combined with those of the ordinary instrument, and has manufactured a large number of such instruments, which are now in use in the principal colleges of the country.

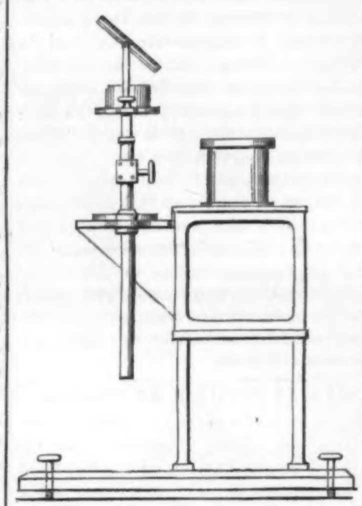


FIG. 11.

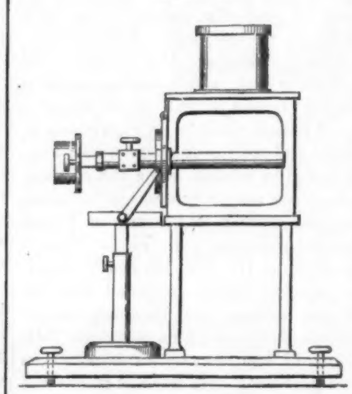


FIG. 12.

Its arrangement is as follows: A metal box, mounted on pillars, contains the source of light; to its front, inside, are attached the collecting elements of the condenser. The condensing element is supported in a hinged plate, to the side of which is also secured a stout rod with rack work, etc., carrying the object glass and upper mirror. When the instrument is to be used as a vertical lantern (see Fig. 11) this hinged piece is raised into a horizontal position, and supported by a triangular case holding the first mirror; and when employed as an ordinary lantern (Fig. 12) this case is removed; the condenser, and with it the rackwork and objective, is lowered and the upper mirror is slipped off. This instrument is probably the most complete, for purposes of demonstration, which has been heretofore constructed. But while it is desirable to have the most perfect appliances where we can, yet much may be accomplished with very simple means. Thus Dr. R. M. Ferguson, in the *Quarterly Journal of Science*, 1872, No. XXXIV., page 267, suggests the following arrangement, in which only such apparatus as is found in any laboratory is needed, in addition to an ordinary magic lantern. The condensers of ordinary lanterns are generally of rather long focus, so that if the light is brought to within about three inches, a bundle of approximately parallel rays will be obtained. An ordinary retort stand is then so arranged in front of the lantern that its lowest ring shall carry a mirror, and the next one a large watch glass filled with water. This makes the condenser; and, if we want to show the motions of waves or cohesion figures, this water-lens itself furnishes the necessary tank. The object glass and second mirror are carried by another ring of the same retort stand. The present writer has further simplified this construction by using a small watch glass, also filled with water, for the objective. This last, indeed, gives us a curious means of illustrating certain relations of lenses. Thus, with the ordinary vertical lantern, we remove the objective and substitute a watch glass. Then, placing a conspicuous picture as an object upon the condenser, we see only a blur of light on the screen; but as soon as a little water is poured into the watch glass, the image starts out with perfect distinctness. If, now, the size of the image on the screen is noted, and alcohol, bichloride of tin, or other highly refracting liquid, is substituted for the water in the watch-glass-objective, we shall find it necessary to bring the lens nearer to the object to secure a good definition; while, at the same time, the image on the screen will be proportionately enlarged. Watch glasses of various curvature may be likewise employed to illustrate the effect of this condition. The only serious objection to the use of water lenses, as above described, both for condenser and objective, is their liability to disturbance by motion, which obliges us to avoid the least jar to the apparatus, since this entirely confuses the image on the screen.

*NOTE.—We are here, of course, neglecting all effects of aberration, or, in other words, are assuming an ideally perfect lens, as the point in question does not depend upon any of the conditions so excluded.

Loose Pulleys.

G. P. says: "I have had great trouble in procuring a small loose pulley that would stand running at a high rate of speed with a very tight belt. After trying a large number of different kinds, of wood and iron, with long and short bearings, bushings of Babbitt, copper, etc., none of which would stand more than two months, I at last procured some sole leather; I put the flat surfaces together and bolted through with four bolts; after boring and turning, I soaked it well in oil and put in place. It has now been running about one year and is, apparently, as good as new. It requires very little oil."

REMARKS BY THE EDITOR.—If a loose pulley is properly arranged, it will run as well as a shaft bearing. It must be long enough, and have efficient provisions for lubrication.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The Introduction of the Metric System into Medicine

was the subject of two papers read by Dr. H. W. Wiley, of Indianapolis, and Professor E. B. Elliott. The former gentleman said the other sciences have adopted a uniform system of weights and measures, and that it is now proper time for medicine to accept the doctrine of science. Proximately, we may take the gramme as 15·5 grains. It is evident that all medicines now given in from one to two grain doses could as readily be presented in gramme doses,since all grain weights could easily be reduced to corresponding terms of the gramme. In regard to fluid remedies, we can make similar reductions.

Thus 1 cubic centimeter equals 16 minims; ·25 centimeter equals 4 minims; 2 centimeters equal 32 minims; 4 centimeters equal 64 minims, equal 1 fluid dram, equal 1 teaspoonful, equal 60 drops.

The paper was principally devoted to the subject of unification of doses, in order to avoid those serious accidents which result so often from the carelessness of physicians, druggists, and nurses. In order to this, both solid and liquid remedies should have a standard dose, say for solids 2 grammes, and for liquids 4 centimeters, or a teaspoonful. This could be accomplished by rubbing up the solids with some inert substance like sugar of milk or chalk, and mixing liquids with mint water.

Professor Elliot harmonizes the metric and apothecaries systems on the basis of the troy grain. If we augment the weight of the troy grain by about three (more exactly 2·88) per cent, the new grain so formed will be contained in the gramme exactly fifteen times—a very simple ratio; and the accidental substitution of this new grain for the old grain and *vice versa*, by the apothecary, would not appreciably change the quantity of medicine in a dose. The following is the scale of relation to the new grain with the metric series proposed by Mr. Elliott:

Proposed Apothecaries Weight.

	Equivalent wt. Troy grains.
5 grains* equal to 1 tergram (⅕ grain)........	5·144+
30 tergrams equal to 1 decagram...........	154·32+
100 tergrams equal to 1 ounce (new)........	514·4+
30 ounces equal to 1 kilogram..............	154·32+

* 1 new grain equal to 1·0288 troy grains.

The corresponding table of measures of capacity is as follows:

	Old Minims.
5 minims* equal to 1 fluid tergram............	5·41830
30 fluid tergrams equal to one centiliter (in fluid decagram)................................	162·54990
100 fluid tergrams equal to 1 fluid oz.........	541·83000
30 fluid ounces equal to 1 liter..............	16254·90000

* 1 new minim equal to 1·083660 old minim.

Professor G. W. Holley discussed

The Proximate Future of Niagara.

Professor Tyndall said that, if the rate of recession named by Sir C. Lyell, a foot a year, was correct, in 5,000 years the Horseshoe Fall would be far above Goat Island, and the American channel would be dry. Professor Holley showed that Sir Charles's rate was the result of a conjecture founded on a guess. He also, by means of the most trustworthy data we have since the commencement of the historic period, showed that it would be more than twice that length of time before the Falls would recede a mile. He also described the formation of the bottom of the river, the course and depth of the different currents and the location of the bars, all of which indicated that the American channel would never be without water.

Professor Tyndall thinks that the depth of the water will determine the course of the chasm channel as the gorge recedes, and the rate of excavation. Professor Holley cited the physical facts which tend to prove that it is the character of the bed of the river, the harder or softer nature of the material to be broken down, that will decide these points. He particularly noticed the fact that the Falls were constantly diminishing in hight as they receded, until they reached their present site, where the river makes an acute angle with its former direction. This was necessarily the case, because they were receding in the line of the dip of the underlying rock. They are now rising on the dip, and will be 50 feet higher than now when they are two miles up stream. To this bend in the river we owe one of the most beautiful features of the great cataract—the rapids above the Falls.

Do Snakes Swallow their Young?

was the title of a paper read by Mr. G. B. Goode, of Middletown University, in which he referred to the habit observed in certain snakes of allowing their young a temporary refuge in their throats, whence they emerge when danger is past. On this subject,through a note inserted in a monthly journal asking for observations, the testimony of 96 persons had been obtained. Of these,56 saw the young enter the parent's mouth in 19 cases, the parent warning them by a loud whistle. Four saw the young rush out when the parent was struck; 18 saw the young shaken out by dogs or running from the mouth of their dead parent; 29 who saw the young enter killed the mother and found them living within, while only 13 allowed the poor parent to escape; 27 saw the young living within the parent, but as they did not see them enter, the testimony is at least dubious.

In the opinion of Professors Wyman and Gill and other physiologists, there is no physical reason why the young snakes may not remain a considerable time in the dilatable throat and stomach of the mother. The gastric juice acts very feebly upon living tissues, and it is almost impossible to smother reptiles. Toads and frogs often escape unharmed from the stomach of snakes. If the habit is not protective, if the young cannot escape from their hiding place,this habit is without parallel; if it is protective, a similar habit is seen in South American fishes of the genera *arius*,*bagrus* and *geophagus*, where the males carry the eggs for safety in their mouths and gill openings.

Professor Gill, in commenting on the above, said that the popular idea that snakes are sometimes swallowed by men and live afterwards in the stomach was an error which he was glad of the opportunity to denounce.

Professor Burt G. Wilder, of Cornell University, read several papers on the general subject of

The Brain.

This organ has been studied with three objects: the descriptive anatomy of its parts, the comparison between the brains of man and apes, the illustration of function. The proper method of preserving specimens was explained and the study of fissures especially commented upon. The speaker said in conclusion: After a pretty careful study of the specimens at my command, and the consultation of all works in which brains are accurately delineated, I feel justified in asserting that we cannot as yet characterize the fissural pattern of any mammalian order, family, genus, or even species, without the risk that the next specimen will invalidate our conclusion: that our studies in this direction should be based upon the careful comparison of accurate drawings of a much larger number of specimens than now exists in any museum; that nearly allied forms of carnivora should be compared; and that the most satisfactory results are obtainable from large series of fœtal and young brains of the same species, and if possible, family and sex, in order to eliminate minor differences.

An Automatic Filtering Apparatus

was exhibited by Dr. H. W. Wiley, which consists of an ordinary filter stone with two arms. The upper arm carries a large funnel of from one to three quarts capacity, an electro-magnet with a system of levers for working a stop to the funnel,and a glass bulb and mercury cup. The lower arm is fitted with an ordinary Bunsen funnel, in which floats the glass bulb attached by a platinum wire to a lever carrying the mercury cup. As the fluid in the small funnel falls, the float sinks, and the mercurial cup rises, until the mercury touches two platinum wires, which are the poles of a small galvanic battery connected with the electro-magnet. This completes the circuit. The armature of the magnet is pulled down, the stop in the large funnel is raised, and the liquid runs through into the small funnel until the connection is broken. This continues until the whole of the fluid runs through into the small funnel. By means of this apparatus the quantitative analyst can save several hours daily.

Dr. J. S. Newberry exhibited a series of exquisitely preserved small scaled

Fishes from the Cannel Coal of Ohio.

In these fishes every scale and fin ray is shown; and the whole animal is coated with a thin film of sulphide of iron and thus "gilded." Sharks' teeth and spines, scales and teeth of large ganoids, and skeletons of many carnivorous salamanders are found all preserved in the same beautiful manner. Dr. Newberry also read a paper in which he said that the different strata which compose the geological column have been divided into several groups or systems, of which the base is formed by the old crystalline rocks called Laurentian and Huronian. Each of these systems consists of circles of deposition; first, sandstone, Potsdam, Medina, etc.: second, mixed mechanical and organic sediments, the calciferous, Clinton, etc.: third, a limestone, the Trenton, Niagara etc.: and fourth, a mixture of mechanical and organic sediment, the Hudson, Helderburg and the coal measures. Dr. Newberry claimed that each of the circles of sediments was formed by an invasion of the land by the sea, producing, first, a sheet of sea beach sand and gravel; second, the offshore deposits following and covering the first; third, the open sea calcareous organic deposit—a limestone; fourth, a mixed sediment—shale and limestone, or an earthy limestone—the product of the retreating sea. Between these submergences perhaps millions of years elapsed, in which the fauna of the sea and the flora of the land were changed. Hence the different fossils of the different geological systems.

Dr. Hill of Portland related a striking anecdote of a toad which had swallowed one end of a large earthworm, and had become so tired in its attempts to get the rest down that it was in danger of losing the whole, the worm crawling out of the toad's mouth faster than it could be swallowed. The toad then brought up its right hind foot, and grasping its stomach and the worm in it, held the worm in with its foot, taking a fresh grip after every gulp, until the job was finished.

In closing the session, Professor Lovering delivered a speech congratulating the members on the extent and variety of their labors during the past year. The usual resolution of thanks to everybody concerned in the affair were adopted, and it was afterward decided to hold the next meeting at Hartford, Conn., on the second Wednesday in August, 1874. The President elected is Dr. Le Conte, of Philadelphia; Vice President, Professor C. S. Lyman, of New Haven, Conn.; Secretary,Dr. Hamlin of Bangor: Treasurer, Wm. S. Vaux of Philadelphia.

Section Q---Scientific Fun.

A burlesque session, in which a number of the members participated,was attended by a large audience, which several learned professors managed to keep in convulsions of laughter for an hour or more.

Professor Morse, taking the chalk, stepped to the blackboard and began the reconstruction of an unknown animal, a fragment of bone belonging to which had been found. Proceeding step by step and speaking as he sketched, he quickly built up the figure of a hideous tomcat. Then he suggested certain anatomical objections and improvements which produced amusing changes in the drawing. Finally he concluded to restore the fragment on a different hypothesis, and by a few strokes revealed the true character of the fossil, which proved to be the handle of a jug. Professor White, discoursing on ancient shell heaps, produced a heavy bag,which, he said, contained specimens collected near Portland. A broken shovel, a stone bottle, a lobster, and a pile of clam shells were recognized, amidst peals of laughter, as relics of the recent clam bake participated in by the Association. Each separate article was then described in connection with the peculiarities of the race that had used it,as indicated by its condition. Perhaps the most amusing of these was a corn cob, which indicated the size of the mouth by the bite that had been taken out of it. A blackboard drawing was then made to illustrate a race with these peculiarities. "You can infer," said the speaker, alluding to a paper of no great value read the previous day, "that the length of this mouth indicates that its maternal grandmamma must have been very long lived."

Several other speakers read ludicrous papers, their remarks being illustrated by Professor Morse with grotesque sketches on the blackboard.

VIENNA PREMIUMS AND SEWING MACHINES.

We copy the following from the New York *Herald* of August 12th:

THE REGION OF THE SEWING MACHINES.

If Dante had been gifted with the spirit of prophecy, he would have set apart a region in his *Inferno* to illustrate the rivalries and emotions of the sewing machine manufacturers of the United States. The conflicts, the misunderstandings, the ambitions, the yearnings for approbation and notoriety, the odd, incessant efforts to win medals of progress and renown and merit and honor, which inspire the gentlemen who manage this industry, have given constant motion and life to the American department. So, when His Majesty came into the sewing machine department, every effort was made by our Commissioners to introduce him to each special machine and explain its peculiar qualities. Let me give you a list of the machines in the catalogue, so you may know what His Majesty was asked to do. First, the Howe Machine Company, New York; then the Singer Manufacturing Company, New York; the Whitney Sewing Machine, Paterson, N. J.; the Wheeler & Wilson Sewing Machine Company, New York; the Wilson Sewing Machine Company, Cleveland, Ohio; the Wilcox and Gibbs Sewing Machine Manufacturing Company, New York; Ezra Morrill & Co., Derby Line, Vt.; George N. Bacon & Co., London, England; the Weed Sewing Machine Company, Hartford, with the patent effective stop motion of Fairchild's attachment; the Secor Sewing Machine Company, New York; the Mackay Sole and Shoe Machine, Cambridge; the Universal Feed Sewing Machine Company. Every exhibitor expected a special visit from the Emperor, and His Majesty, with a patience and courtesy that should be commended, endeavored to visit them all.

After waiting a few minutes to comprehend the explanations to him of the advance of the industry so largely represented in America, the Emperor continued his tour of the other departments, especially inquiring of his attendants what different principles were presented by each separate machine, in what respect one machine differed from the other—all of which was explained to him, especially the new principle of the patent stop, or the application invented by Mr. Fairchild, and now owned by the Weed Machine Company, by which the action of the needle is arrested by the pressure of a spring, without stopping the motion of the wheel.

In the New York *Herald* of August 19th, we find awards were made as follows:

To the Wilson Sewing Machines of Cleveland.

Elias Howe Sewing Machine Company, for sewing and stitching.

Wilcox & Gibbs Sewing Machine Company of New York, for best single thread sewing machine.

The Weed Sewing Machine Company, for best stop motion applied to sewing machine treadles.

The Wilson Sewing Machine Company being the only exhibitor that received a grand prize medal for the best sewing machine, and medals of honor.

Small Fast Steamers.

J. G. X. states that he and a friend are building a small steamer, of the following dimensions: Length 24 feet, width amidships 6 feet 4 inches, hight amidships 3 feet and at stern 4 feet. She has a white oak keel, her ribs are of hickory, and she is built up with a double thickness of half inch white pine boards, all joints being lapped and tarred. She is covered with sheet zinc, the joints being lapped and soldered. "The boiler is an upright tubular, 3 feet high, 20 inches diameter, and has 19 two and a half inch flues, with a fire box 18 inches diameter and 1 foot high. The engine, attached to the boiler perpendicularly, is of about the same power as the boiler, and has double cranks set at right angles. The boat will be propelled by a 20 inch screw of four blades, each blade having a pitch of 6 inches, with space between each blade of one third the size of blade, and is so constructed as not to make any wave towards the banks of the canal. She is expected to run at from 8 to 12 miles an hour. The boat and all the machinery have been constructed by us two, it being our first piece of carpenter work. We are both machinists, and everything was done between work-

ing hours, and together we spent twenty days on the wood work. She is to be used as a pleasure boat on the Schuylkill canal, and will carry about 30 passengers."

DECISIONS OF THE COURTS.

United States Circuit Court--District of Kentucky.

PATENT BALING PRESS.—WENDELL E. KING *vs.* THE LOUISVILLE CEMENT COMPANY.

BALLARD, *J.*:

The complainant in his specifications declares that his "invention consists in the arrangement in one apparatus of two presses, which are operated alternately by a single screw in such manner that turning the screw in one direction to compress the bale in one compartment of the press retracts the follower and releases the bale in the other compartment thereof, so that said bale may be readily removed as desired, thus by said simultaneous and alternating action avoiding all loss of time in operating the press." *

The complainant does not claim any of the separate parts of this machine. He claims only the combination of the gearing with the screw and the boxes, when constructed and operating substantially as described.

The machine used by the defendant, like that of complainants', is provided with two boxes, a screw between and extending into both boxes, and a gearing by which the slow and rapid motion is obtained.

The same result substantially is accomplished by each machine. *

The mechanical powers employed in both of the machines have been long known, and it is hardly necessary to prove, what the testimony, however, does establish, that it would occur to the merest tyro in mechanics that a substitution of the gearing employed in defendant's machine for the gearing employed in complainant's would enable him to accomplish the same results which complainant's do. As he would substitute strictly mechanical equivalents, it is obvious he would produce the same results, and by an operation really similar, though somewhat disguised.

The question then is—the complainant's patent being admitted to be valid, though it is for a combination—can the defendant avoid the charge of infringement by substituting, in lieu of some of the parts of the combination, well known mechanical equivalents? I am quite sure that he cannot, either on principle or authority.

It is not to be disputed that the inventor of an ordinary machine is, by his letters patent, protected against all mere formal alterations, and against the substitution of mere mechanical equivalents. Why should not the inventor of a mere combination receive the same protection? If he cannot, then will his patent not be worth the parchment on which it is written. If no one can be held to infringe a patent for a combination unless he uses all the parts of the combination and the same identical machinery as that of the patentee, then will no patent for a combination ever be infringed, for certainly no one capable of operating a machine could be incapable of adopting some formal alteration in the machinery, or of substituting mechanical equivalents. No one infringes a patent for a combination who does not employ all the ingredients of the combination, but if he employs all the ingredients or adopts mere formal alterations or substitutes for one ingredient another, which was well known at the date of the patent as a proper substitute for the one withdrawn and which performs substantially the same function as the one withdrawn, he does infringe. *

I have not examined minutely the testimony of the experts produced by the respective parties in this case, because I do not ordinarily attach much importance to the opinions of witnesses so produced—I find them generally advocates of the party producing them—and I have rarely ever derived any assistance from any expert who was not summoned and examined on the suggestion of the court itself. But in this case I have not referred to their testimony, chiefly because the nature of the complainant's invention and of the operation of both his and the defendant's machines is so easily understood that assistance has not been needed.

Being of the opinion that the machine used by defendant is clearly an infringement of complainant's patent, I shall direct a perpetual injunction and give a decree for costs, but as complainant has offered no proof touching the damages, and as they must be small, I shall direct no inquiry concerning them.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 19 to August 21, 1873, inclusive.

GAS REGULATOR, ETC.—C. E. Seal, *et al.*, Winchester, Va.
HULLING RICE, ETC.—G. L. Squier, *et al.*, Buffalo, N. Y.
LAMP, ETC.—J. D. Whidden, *et al.*, Chelsea, Mass.
PANEL AND MOLDING MACHINE.—L. McD. Hills, New Haven, Conn.
STEAM ENGINE.—G. G. Loodell, Wilmington, Del.
TRACTION ENGINE.—R. C. Parvin, Farmington, Ill., *et al.*
TREATING FABRICS.—J. T. Waring, Yonkers, N. Y.
TURPENTINE PRODUCT.—R. Lloyd, New Orleans, La.

Recent American and Foreign Patents.

Improved Combined Spade and Fork.

Heber Stone, Galveston, Texas.—The object of this invention is to adapt a fork to be used as a spade: and it consists in a sheet metal sheath or pocket adapted to receive a fork and be secured thereto. When the fork is inserted in the sheath, a ring on the handle thereof is slipped down over projections, and thus the sheath is secured to the fork, and the same is thereby converted into a spade.

Improved Tyre Shrinker.

Robert Gibbs, Spring Hill, Mo.—This invention consists in a new mode of shortening tyres by means of a slide bar gage and hook lever, which enable the work to be done very effectually as well as very quickly. The mechanism is easily and cheaply prepared, and withal not liable to get out of order.

Wood Filling.

Jerome B. Dittenhaver, Chapalear, Ohio.—This invention relates to a compound for filling wood previous to the application of paint or varnish, and consists in a preparation, which is entirely devoid of color and will not therefore change the characteristic hue of the wood, which can be applied with an equally favorable result to all varieties, and which permeates so thoroughly the pores and fills so completely the interstices between the fibers that a single coat of varnish or paint will be generally sufficient to produce the designed outside face upon the wood.

Improved Washing Machine.

Henry H. Mercer and Samuel Mehaffey, Cambridge, Ohio.—This invention consists in a machine possessing in an eminent degree three essential elements of a good washing machine, namely: Friction, pressure, and concussion. The lower roller being composed of polygonal rolls, each of which has an independent movement, a greater amount of friction is produced than by a cylinder composed of round rolls. The shape of the rolls results in carrying the materials under the pressure roller, instead of drawing or pulling them under, as is the case with solid rollers composed of round rolls, thereby preventing the clothes from stretching or being torn or in anywise injuring or interfering with buttons, buckles, etc. It is also much easier to operate than any other machine now in use, as it requires less power to carry materials under the pressure roller than it does to drag or pull them under the same, by the kind of motion common to the kind of rollers now in use.

Improved Cotton Press.

Michael M. Scherer, Batesville, Ark.—This invention consists in providing with a gravitating cover the press box, and winding it up by a windlass mechanism; in supporting the follower on the outside ends of the press box upon a wheeled carriage; and finally, in the peculiar construction and location of the press box.

Improved Ice Casket.

Frederick N. Troll, Baltimore, Md.—This invention relates to burial caskets for preserving the bodies of deceased persons until it is convenient for their friends to bury them, and consists in providing, between the body receptacle and casket, a pipe connection through which the air may be exhausted; also, in applying a rubber lining to the inside of the casket and cover to exclude all air from the outside.

Improved Car Coupling.

E. N. Gifford, Cleveland, Ohio.—This invention is an improvement upon the coupling for which letters patent were issued to A. Pritz, March 25, 1873, and consists in forming a right angled slot or recess in the side of the coupling or catch, and a right angled notch in its forward edge to adapt it to be held in place, and also guided in its movements by a short cross bolt projecting through the side of the drawhead.

Improved Paint Compound.

Charles Campbell, New York city, assignor to himself and James H. Davidson, of same place.—This invention relates to a new composition for paint, whereby the paint is held perfectly in solution without settling, combining the pigment and oil, producing a glossy and consistent covering for the preservation of wood work and other bodies, and effecting a considerable saving in the pigments employed. The solution is prepared by dissolving bicarbonate of soda and borax in water. This is then mixed with dry oxide of zinc, linseed oil, and benzine, and thoroughly ground together, producing a glossy, cheap, and durable paint compound, which may be used as any desired shade or tint by adding the necessary color to it.

Improved Terret and Martingale Ring.

John Geraghty, Jersey city, N. J.—This invention consists of a fluted roller and pawl to be used in the terrets and martingales in substitution of the ordinary check rein rings for guiding and controlling the reins; also, for aiding the driver in controlling the horse by turning freely with the rein when pulled backward by the driver, but not turning in the other direction, so that when the horse gets advantage of the driver he must also overcome the friction of the reins on the rollers.

Improved Trace Buckle.

John Kennedy, Osage Mission, Kansas, assignor to himself and John Moffit, of same place. This invention consists in a trace buckle in which the tongue is pivoted and provided with a lock. As the trace is passed forward the tongue enters the hole therein; and as it draws back it pulls the tongue plate into the angular recesses in the lugs of a plate, and thereby locks the same. This movement of the tongue is effected by slots in the plate. With this buckle the trace is kept straight and smooth, without cracks or wrinkles.

Combined Fender and Ash Sifting Attachment.

William C. Dobbin, Zanesville, Ohio.—This invention is a combined fender and ash sifting attachment, to be used in connection with an ordinary fireplace fire grate, for the purpose of separating the ashes from the unburnt pieces of coal that fall from the fire grate, so that the latter can be readily replaced upon the fire freed from ashes.

Improved Car Coupling.

John Crist, Tiffin, Ohio.—This invention relates to automatic car couplings wherein the link lifts a catch hook by its own forward movement, and consists in attaching said hooks to a bar pivoted at the rear end, held down by a spring and lifted by a vertical rod. It also consists in a novel and effective mode of raising the lift rod.

Improved Cotton Bale Tie.

William J. Orr, Charlotte, N. C.—This invention relates generally to bale ties, but particularly to that class consisting of a strap of thin metal having one end turned into the form of a hook, and the other end broadened into a transversely slotted eye piece provided with a side stop at the outer end of the slot. There has been experienced, practically, with these bale ties a good deal of difficulty in turning the band after it is tightened sufficiently to secure the hook and eye together, while there is necessarily more or less play of the hook in the eye afterwards, which causes the sleeve to become displaced and the bale to become loose and even untied. The invention consists in the peculiar mode of arranging and constructing this eye piece so that it can be easily inserted within the hook of the strap and be securely held, with or without the sliding sleeve or loop which is sometimes used.

Improved Composition for Waterproofing Wall Paper.

Cornelius Van Herwerden, Williamsburgh, N. Y., assignor to himself and Cornelius Jansen, of same place.—This invention has for its object to furnish wall paper which shall be so prepared that, when applied to the wall in the ordinary manner, the papered wall may be washed, and which will leave the colors upon the paper wholly unaffected. The invention consists in first dissolving white soap in warm water. When fully dissolved, white wax and isinglass are added and the mixture stirred continuously until it boils. When fully cold it is ready for use. To apply the mixture, the paper is spread upon a smooth table, and the former is applied with a soft brush, care being taken to cover the paper evenly by rubbing it well with the brush. The paper is then rubbed with a dry brush to give it a gloss.

Improved Glove Fastening.

Charles H. Hall, Trenton, N. J., and Robert Knott, Brooklyn, N. Y.—This invention consists of a little bar with a series of notches in each edge and wide portions between the notches, hinged to a clip fastened to the glove at one side of the slit for the wrist, and a notched hook on a clip fastened to the glove at the other side, so arranged that it can engage the bar behind any one of the enlargements to fasten the glove tight or loose, as may be desired. The clips by which the bar and the hook are fastened to the glove consist of thin plates of silver, gold, or any ductile metal, with spurs formed on them, to fasten them to the glove, by punching them out of the metal in the ordinary way of making such fastenings.

Improved Ice Shaving Machine.

James D. Freeman, Abbeville, Ala., assignor to himself and James Gillespie, of same place.—This invention furnishes an improved machine for attachment to the counter in soda water and other saloons for shaving the ice. The forward parts of the downwardly projecting sides of a hopper are cut away to allow a tumbler to be placed beneath said hopper to receive the shaved ice. In the lower part of the hopper is placed a small cylinder, to which are secured a number of knives or cutters, rotated by a crank. The piece of ice is placed in the hopper, rests upon the cylinder, and is held down by a plate which is placed upon it, and which is attached to a lever. The lever passes through slots in the hopper, and its forward end is pivoted to a plate which slides up and down in a groove. The latter plate may be raised and lowered to adjust the position of the lever and plate according to the size of the piece of ice to be operated upon. The rear end of the lever projects so that the operator can grasp it in one hand to hold the ice down with the requisite pressure while he operates the crank with the other hand to shave the ice.

Improved Insect Powder Gun.

William Henry Ball, Brooklyn, N. Y.—The object of this invention is to provide a commercial package for insect powder, which may also be used as a gun or ejector for discharging the powder into crevices, etc., at the same time that the cost will not be much more than common packages. The invention consists of a cylindrical box, of light and inexpensive material, and a short piece of flexible tube joined together at one end, the paper or wood box having a cap at the other end, and, by preference, a hopper, shaped bottom at the end connected to the flexible tube, with a small hole for the powder to pass from it into the said flexible tube. The latter has a small nozzle through which to eject the powder by compressing the tube, the nozzle being detachably connected so as to pack the packages economically. The hopper bottom is employed to retain the mass of the material in the paper or wood box in which it is packed and deliver it into the flexible ejecting portion in small quantities as the box is shaken.

Improved Steering Apparatus for Vessels.

Amie Siebenthal, Vevay, Ind., assignor to himself and F. R. Dufour, of same place.—The object of this invention is to construct for river and ocean vessels an improved steering apparatus, by which the power transmitted to the rudder is equalized, and the same more fully within the control of the helmsman. The invention consists in the hinge connection of the tiller with the rudder post, together with a supporting guide arm of the same. The nearer the tiller approaches the center, the quicker turns the rudder post, so that the rudder moves rapidly when in position at either side of the axis of the vessel, where also less power is required. On the approach of the tiller to a horizontal position, the rudder moves with decreasing speed but with increasing power, as the pivoted arm relieves the strain on the steering rope by supporting the end of the tiller.

Improved Composition Filling for Painters.

Richard Sharp, Pittsburgh, Pa.—The object of this invention is to provide for carriage manufacturers an improved "painters' rough stuff," which is put on after the paint, and leaves a smooth and solid surface after rubbing. It consists of a mixture of pulverized pumice stone and white lead, thinned by coachmaker's japan and rubbing varnish. The wood is first filled with from three to five coats of keg lead, and then coated with this surface protector, which causes the work to take a fine polish.

Improved Cotton Bale Tie.

William Crone, Galveston, Texas.—This invention consists of a small S shaped bar for tying the bands and cross ribs on the bands, both lower and upper sides, at short distances apart near the ends, which are fastened together. This is effected by inserting the band in the notches of the aforesaid bar, one part on each side, in a very simple manner.

Improved Straw Cutter.

Thomas Webb, Elyria, Ohio.—This invention is an improvement in the class of straw cutters having feed rolls, one of which is adjustable vertically, and yet so geared with the stationary roller as to continue its revolution, whether they are separated by a small or large quantity or thickness of the material to be cut.

Improved Tool for Seating Bung Bushes.

Lomax Littlejohn, New York city.—This invention has for its object to furnish an improved tool for beveling the bung hole of a cask and countersinking said hole to adapt it to receive a bung bush. The body of the tool is cast hollow, and of such a taper as will give the desired bevel to the bung hole. In one side is formed a recess to form a seat for the knife cutter, in which, directly opposite the edge of the cutter, is a slot for the chips to escape through. Around the upper edge of the tapering body is a flange of a breadth equal to the desired breadth of the countersink of the bung bush. Upon the upper side of the flange are formed two projections, one of which is so arranged that its face may be nearly flush with the edge of the flange, so that the cutter attached to said face and the cutting point may project below the flange to cut around the edge of the countersink. The other projection is arranged across the flange so that the cutting edge of the cutter may project through a notch in the flange to cut the countersink. Upon the upper edge of the body is formed a rigid bail, having a socket formed upon its upper part to receive a handle, by means of which the tool is operated.

Improved Saw Swage.

Andrew J. McCollum and George D. Emery, Indianapolis, Ind.—This invention consists of an improved attachment of a saw swage, by means of which the swage will be held perfectly square across the tooth, so as to make all the cutting points exactly alike, and thus enable the saw to be filed much more quickly than it could otherwise be done. The invention consists in the guide arms connected at their upper ends by a back, and pivoted to the stock of the swage. The guide arms are provided with a set screw which passes through one of said arms and screws into the other arm, so that the lower ends of the arms may be adjusted closer together or farther apart, as the thickness of the saw plate may require. By using the swage upon the teeth of a saw partly filed, and then filing the teeth by the marks of the swage, it is claimed that the saw may be filed in less than half the time that would otherwise be required.

Improved Inside Blind.

Elliott Metcalf, Rome, N. Y.—This invention has for its object to improve the construction of Venetian or inside blinds, and it consists in the arrangement of an upper roller, carrying front and rear ribbons, attached to the slats of the blind, and provided with cords for suspending the same, so as to enable the blind to be lowered and raised from the top. This, together with the angular adjustment of the slats is effected by turning the roller. The vertical movement of the slats from the bottom is accomplished by elevating cords. The invention further consists in a novel method of attaching the slat-shifting ribbons to the latter, dispensing with the use of rivets, staples, or other fastening devices, and insuring, also, a more perfect closing of the slats; and it consists in passing or looping the ribbons through slots near the edges of the slats, so that when the latter are in a vertical or closed position the edges of the same will abut more perfectly than in ordinary blinds.

Improved Paint Brush.

Amasa S. Thompson, Little Falls, Minn., assignor to himself and Louis Vassly, of same place.—This invention is intended to furnish ready and convenient means for raising and discharging paint and similar substances, which are applied with a brush, through the brush, so that the fluid may be readily spread by the operator. The invention consists in a rubber syringe and flexible tubes provided with suitable valves and arranged in the handle of the brush. A tube conducts the liquid from the reservoir to the apparatus.

Improved Plow.

Thomas G. Andrews and Andrews Riviere, Barnesville, Ga.—This invention consists in the construction of plows, so that the plow plates may be secured firmly to the standard without bolts, and in such a way as to present no unevenness for the soil to catch upon, and which will enable the plow gate to be quickly attached and detached. It consists of a lever brace, pivoted at its rear end to the slotted lower end of the plow standard, secured at its forward end detachably to the plow beam, and provided with a shoulder or pin for securing the plow plate detachably to said standard.

Improved Spark Arrester.

Michael Zech, Pittsburgh, Pa.—The cinders and sparks are deflected by a inverted cone (the upper parts of the stack) drawn through a perforated flange, and ascend and pass through a circular opening and then strike a horizontal disk, and are thrown in each direction. They are still further retarded before they escape by an interior flange around the top of the hood. Before reaching this point the sparks or cinders are broken up, so that when they escape from the hood any fire which they may retain is instantly extinguished by contact with the atmospheric air.

Improved Reed Organ Swell.

John R. Lomas, New Haven, Conn., assignor to Bernard Shoninger, of same place.—The design of this invention is to make a clear and open passage for the escape of the sound from the reeds through the case of the instrument; and it consists of a movable board or outside swell in the case, with a suitable connection with the ordinary swell, or the lever which operates it, to be opened by or with the said ordinary swell, and allow all the sound waves a clear, open, straight passage through the case, whereby a large gain of power is obtained without any extra exertion on the part of the player, at any desired time, giving nearly double the effect of the front reeds.

Improved Carpet Lining Machines.

John R. Harrington, Brooklyn, N. Y.—This invention relates to a combination of revolving screens, carding cylinders or scratchers, and feeding and condensing rollers, the object of which is to receive the cotton, flock, or other fibrous material from a willow or breaker, form it into a smooth lap of uniform thickness, and deliver it between sheets of cloth or paper, which form the upper and lower surfaces of the complete fabric and confine and secure the lap. The inventor, we believe, is the originator of carpet linings made with one or more continuous sheets of paper or cloth united together by mucilage or sewn. The capacity of the machines is claimed to be 5,000 yards per day. Mr. Harrington has taken several patents on the same subject, but he asserts that the invention now under consideration is preferable to any other.

Improved Railway Rail Chair.

Samuel Huber, Danville, Pa.—The main object of this invention is to prevent the ends of the rails of railroad tracks from being battered or damaged by passing trains, and it consists of a cavity or recess beneath the joint of the rails, whereby a certain degree of elasticity is allowed the ends of the rails.

Improved Manufacture of Boots and Shoes.

John Boyle, New York city.—The object of this invention is to provide an improved clamping connection of textile or other fabrics with hard and unyielding materials, as wood or composition soles, etc., so that shoes or other articles of manufacture may be produced quicker and cheaper by means of machinery, and the hand labor, hitherto necessary for such work, be dispensed with. The invention consists in grooving the wood sole or other material at the upper edge, and binding the fabric, by a suitably shaped metallic clamp, firmly thereon, so that a strong and intimate connection of the parts is obtained.

Improved Printing Press.

Calvert B. Cottrell, Westerly, R. I.—This invention consists in gearing the sliders with the frame of the press, also with the reciprocating type bed to maintain the proper relation of said sliders to the table at all times, and prevent the overrunning of one by the other, which now happens in consequence of the irregular action of the bed on the sliders, caused by the pressure of the cylinder on the bed when going one way and the freedom from pressure when going the other way.

Improved Rubber Shoe.

Lewis L. Hyatt and Jared H. Canfield, New Brunswick, N. J.—This invention consists of india rubber boots and shoes, the uppers of which are made considerably thicker and stronger at the junction with the sole than at the top and in the upper portions, and gradually lessening in thickness from the bottom upward. In carrying out the invention dies, are sunk in the rolls, by which the sheets for the upper portions of the shoes are made deeper in the parts in which the lower portions are formed than in the parts whereon the upper portions are formed, and thus the required variations in the thickness are produced at the same time that the sheets are made.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

ANSWERS TO CORRESPONDENTS

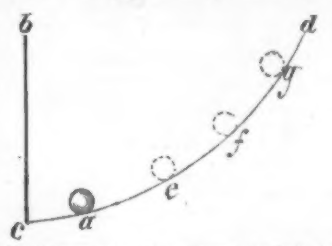
J. E. R. should try to blue his steel articles by the process mentioned on p. 107, vol. 26.—C. H. D. will find a method of making bone phosphate detailed on p. 343, vol. 26.—R. W. should read the answer on p. 362, vol. 25, for a good black dip for metal articles.—E. C. M. will find a description of the horticultural fertilizer on p. 401, vol. 28. It should be phosphate of ammonia, not biphosphate.—D. R. is informed that the published accounts of phospho-bronze do not mention the proportion of phosphorus, which can doubtless be ascertained by experiment.—H. J. H.'s query as to the names of the steam engine is incomprehensible.—T. A. C. can find the proper weight of ball proportioned to length of lever for a safety valve by applying the formula on p. 106, vol. 25.—S. H. W. should read some elementary work on chemistry, and had better advertise for the other information.—J. T. L.'s query is a trade matter; he should consult an engineer.—We are obliged to G. & C. for their correction; the mistake was not ours.—P. P. can bronze cast iron by using the process described on p. 58, vol. 26.—B. L. B.'s equation is a catch; the answer may be either 18 or 2, as the *data* are not properly expressed. —W. B. J. will find the needed information as to mold for plaster ornaments on p. 138, vol. 29.

E. F. L. asks: Would two steam boilers of equal capacity, one an upright and not walled in, the other a horizontal and return tubular, walled in, each having thirty-three feet of smoke stack, do the same work with the same coal? Which would be the most economical, and what per cent will the one save over the other, and why? Answer: We suppose the horizontal boiler would be the most economical, because it would be better protected against loss of heat.

G. D. asks: Does it require more force to bring a moving body to rest than it does to give it the motion? I should say not; yet it would seem to be so, if I rightly understand your reply to J. B. T., page 77 of the current volume. I reason that if an engineer can jump from his engine at the rate of 15 miles an hour, it makes no difference, so far as his relation to the engine is concerned, whether it is in motion or at rest. If the engine is moving west at the rate of 15 miles an hour and the engineer jumps east with the same velocity, when he strikes the earth he will be motionless. Is not this so? I think J. B. T. mistaken in thinking that "engineers, etc., invariably jump in the direction of the moving train." It is true that they face in that direction, but they usually jump with a swinging backward motion, making the head and body move as rapidly as possible in the direction opposite to the train. If an engineer jump backwards with a velocity of ten miles an hour, and the train is moving in the opposite direction at the rate of 25 miles an hour, he strikes the earth with the velocity of only 15 miles an hour, the force of which can easily be resisted by an ordinary man. Active base ball players frequently fall without injury when running with a speed of from 19 to 20 miles an hour. Answer: It is true that it takes no more force to stop a moving body than is required to impart the motion to it; but the question of time plays an important part in many cases. We will try and make this plain, by a few simple illustrations. Suppose a train is moving at the rate of 30 miles an hour, and strikes against something which stops it instantly. Now if a man were standing up in that train, facing to the rear, the effect would be the same as if he were to jump with a velocity of 30 miles per hour; and on our correspondent's theory, he ought to remain standing and uninjured. On the contrary, we know that he would perform a few involuntary somersaults, and the chances would not be very favorable for his escaping with his life. This is because, though just as much force was brought to bear to stop his motion as had been used in producing the motion, there was an amount of work stored up that required time as well as force to overcome it. A train moving from a station starts slowly, and gradually acquires speed, so that the passengers are not much affected by the increasing velocity. But if the train started abruptly at a speed of 30 miles an hour, couplings would break, passengers would be thrown in all directions, and general havoc would be the result, for the same reason as before, that time is required to impart a rapid motion to a body, if it is to be done without shock. We might multiply these illustrations to any desired extent. Suppose we have a fly wheel with a heavy rim and crank attachment, and that a man working on this crank makes the wheel revolve at a high velocity. Now let him try to stop it suddenly, and he will find that the power stored up in the wheel is sufficient to lift him off his feet, and throw him to some distance. The case instanced by our correspondent, of base ball players, will also serve as an illustration. Probably one of these players rarely runs faster than at the rate of 18 miles an hour, and so many accidents have happened at first base by the difficulty of stopping suddenly without injury that the rules have been amended, and a player on reaching first base does not have to hold it, but may run over it and cannot be put out, until the ball has been returned to the pitcher. Our correspondent is right in remarking that persons jumping from a moving train face in the direction of the motion, and hold back. Some years ago, a man in Schuylkill Haven used to excite the admiration of all who saw him by jumping from a train which was moving at the rate of 25 miles an hour. He may still display his agility and nerve, for aught we know, although it must be confessed that this proceeding was somewhat risky. His plan was to go to the rear platform, place his feet on the buffer and his hands on the rail, leaning back as far as this position would allow. When he reached the place where he desired to stop, he would dexterously release his hands and feet simultaneously, and reaching the ground in an upright position, would walk off to his work with an unconcerned air. We are not relating this incident to induce our readers to go and do likewise. If they are very desirous of experimenting let them try it on a street car, where the only results of failure will be a few bruises and the derision of the bystanders. We once knew a man who jumped from a canal boat, in a direction contrary to that in which it was moving. He made some miscalculation, apparently, for, instead of landing gracefully on his feet, his head collided with the ground, and he went home a wiser and a sadder man. We think there is one case in which a person could jump backward from a moving train, if everything were propitious. Let him start at the front end of a platform car, and run back as fast as the train was moving forward; then he could jump with safety. But a slight miscalculation might disarrange the experiment.

W. H. M. says: In your answer to M. C., in No. 8, Vol. 29, you say: Multiply the diameter of the cylinder by the decimal ·7854; is this not an error? Should it not be the square of the diameter? Do you deduct anything for friction? 2. What books should a young man read so as to get a good idea of machinery in general, and about what would they cost? Answers: 1. It should be the square of the diameter, of course. In calculating the indicated horse power of an engine, no deduction is made for friction. We endeavor to avoid mistakes of this character, and will thank our readers to point out errors whenever noticed. 2. Appleton's "Dictionary of Mechanics," price $20.00, will give you a good general idea of machinery. Spon's "Dictionary," now in course of publication, by the same author, is later and more complete.

C. H. A. says: Suppose a ball, *a*, to be revolving around an axis, *b*, say 60 times a minute; is it possible to draw a curve, from *c* to *d*, such that its tangent shall be at right angles to the resultant of the forces of gravitation and centrifugation acting on the

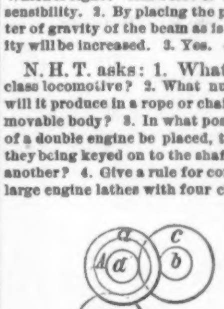


ball at whatever point of the curve the ball shall be placed, say at *e*, *f*, or *g*, the number of revolutions being constant? Answer: The curve is a parabola, with vertix at the lowest point. We would be glad to receive a solution of this problem (which is quite simple) from some of our readers.

R. L. asks: Can a correct test of the strength of a bridge be made from a model, one inch to the foot and in exact proportion to one of full size? Answer: Small models are generally stronger, in proportion to their size, than the actual works.

F. P. says: In constructing a pair of scales, as sensitive as possible, (1) is there any rule as to the relative length of beam, and chains or threads to which the cups are attached? 2. The two holes being made at each end of the beam, and a straight line drawn, how far above the line in the center of the beam should the pivot be, to make the most sensitive results? Will the scales be more sensitive with the pivot just as near the line as the beam will equipoise than if the pivot were farther? 3. Will the knife-edged pivot be as delicate a mode as any? 4. A friend says that the index above the pivot must be of a certain length and weight to make the scales sensitive. I contend the index is merely a pointer and has nothing to do with the sensitiveness. Which is right? Answers: 1. This does not affect the sensibility. 2. By placing the pivot as close to the center of gravity of the beam as is practicable, the sensibility will be increased. 3. Yes. 4. You are right.

N. H. T. asks: 1. What is the cost of a first class locomotive? 2. What number of pounds strain will it produce in a rope or chain fastened to some immovable body? 3. In what position should the cranks of a double engine be placed, to act to the best effect, they being keyed on to the shaft at right angles to one another? 4. Give a rule for compound gearing used on large engine lathes with four change gears. Answers: 1. About $12,500. 2. About 5,000 pounds. 3. Each 45° from middle position. 4. Let t = threads per inch on lead screw, and T = threads per inch to be cut; n = revolutions per minute of lead screw to one of main spindle. Then T × n = t. To find n, for any number of change wheels: Let A = number of teeth in gear on cone spindle. B = teeth on 1st stud wheel. C = teeth on 1st stud pinion. D = teeth on 2nd stud wheel. E = teeth on 2nd stud pinion. F = teeth on 3rd stud wheel. G = teeth on 3rd stud pinion, etc. L = teeth in wheel on lead screw. Then if N = number of revolutions of lead screw to one of cone spindle, $N = \frac{A \times C \times E \times G}{B \times D \times F \times L}$. And if M = number of revolutions of main spindle to one of cone spindle, n = N ÷ M. To find M. a = teeth in wheel on cone spindle, b = teeth in 1st wheel on back speed shaft. c = teeth in 2nd wheel on back speed shaft. d = teeth in wheel on main spindle. Then $m = \frac{a \times c}{b \times d}$. The accompanying engraving will probably make the rules clear.



F. E. H. asks: What would be the average difference in weight of a loaded freight car and one unloaded? Answer: Weight, nine tuns empty, nineteen tuns loaded.

A. K. asks: 1. Would it pay to own and run a grain separator where coal is cheaper than wood? Coal is $8 per tun at the bank, distance to be hauled from 2 to 12 miles. 2. How much coal would be consumed by a 20 horse power engine in a day's work of 12 hours? Answers: 1. We think so. 2. Probably between 1,500 and 2,000 lbs.

W. H. L. asks: How can I get a grease spot from a book? Answer: Apply refined benzine with a sponge or rag, to the grease spot.

H. F. U. asks: What shaped nozzle will send the longest and most solid stream from a fire engine, *cæteris paribus*? Answer: The nozzle which has the form of the contracted vein, (see article on "Efflux of Steam," page 118, current volume.)

A. K. asks: How much of an inch square must a steel bar be made, to support a weight of 3,000 lbs. the bar to rest on supports 2 inches apart? What are the formulas, if weight or the distance of the supports be increased? Answer: The amount of cross section will depend upon the form, and the distribution of the weight. We will give you two rules for a steel bar, and you can assume different depths, weights and distances between supports, to find the various widths required under different circumstances. 1st. If the weight is suspended at the center the width of the bar in inches is equal to the clear span in feet multiplied by the weight in pounds, divided by the square of the depth in inches multiplied by 1,000. 2nd. If the weight is uniformly distributed, the width of the bar in inches is equal to the length of clear span in feet multiplied by the weight, divided by the square of the depth in inches multiplied by 2,000.

A. B. asks: Why is it that a saw heats on the rim in sawing hard timber, when in soft timber it runs very well? 2. Ought a circular saw to be hollowing on the log side, or perfectly straight? Answers: 1. Your saw is undoubtedly what saw makers call open on the rim, or possibly it may not be in proper line with the carriage; generally board circular saws are lined with the front or cutting portion a little nearer to the carriage than the back part of the saw, in order to prevent the teeth cutting or scratching the timber; this causes the saw naturally to incline towards the log and bear against the guide. The harder the timber, the more resistance it requires to keep the saw in proper position; consequently the greater friction, in sawing hard than soft timber, causes it to heat on the rim. If it is more open at the rim than in the body of the saw, the least amount of heat expands it, and causes it to heat still more. 2. A saw should be flat on the log side, and not hollowing. It had better be a very little full or convex on the log side, but in no case so much as to permit any portion of the plate to touch the timber.—J. E. E., of Pa.

L. S. says: I noticed in your answer to J. H., page 125, current volume, you recommend him to use Davies' "Algebra" and Legendre; but you will find that, although they were the best in your day and mine, they are far behind Robinson's "Algebra," especially his "University Algebra," and Greenleaf's "Geometry," which, on examination, you will find very practical. However, the Legendre style (which they follow) never satisfied me. There is none of that solid reasoning found in Playfair's "Euclid" or Potts' "Geometry." The latter is an English work reprinted in New York. Answer: We are quite familiar with the works you mention, and mentioned the most suitable text books, according to our judgment. At the same time we are glad to receive the opinion of others. In an article recently published we have intimated that it was of more importance how the subject was studied, than what text book was used.

N. D. H. asks: In building an engine to propel a boat with twin screws, would friction gear work to more advantage than cog wheels? The latter are often used on such boats on the Western canals, and make a rumbling and disagreeable noise, and are liable to get out of order. Answer: Friction gear will work very well, if properly constructed. It is well to have V shaped grooves in the wheel or pinion, having V shaped projections on the other.

D. asks: 1. How can I make chloroform, and how is it administered to make a person sleep one hour? 2. How is acidulous mineral water made? 3. How is lemon syrup made? 4. Whose work on chemistry would you advise me to get, that is, whose is the most complete? Answers: 1. Chloroform is made by distilling a mixture of alcohol and chloride of lime. It is administered by means of a saturated sponge or handkerchief placed over the mouth of the patient, but we would advise you in no case to attempt to experiment with reference to its anæsthetic properties, as serious results might follow. Its administration should be left entirely to an experienced physician. 2. By charging water, with which the proper chemical ingredients have previously been mixed, with carbonic acid gas. 3. By mixing lemon juice or citric acid with sugar syrup. 4. As an elementary work, Roscoe's or Bloxam's.

J. P. asks: Is there any method of preparing cloth or thin leather so as to render it impermeable to air without destroying its pliability? The ordinary rubber cloth is not, and I am told cannot be made, thoroughly air tight. Answer: We should judge that the cloth, from which what are known in England as mackintoshes are made, might serve your purpose. This cloth is prepared by coating two sheets of cloth on one side only with india rubber varnish and then pressing the varnished sides together by means of rollers so as to make one sheet. Thin leather might be treated in the same manner.

R. C. asks: 1. What is the difference between gold-bearing quartz and common quartz? 2. How is gold separated from quartz? 3. Does common sand contain gold; if so, about how much to a bushel of sand? 4. What are crucibles made of? 5. How can I separate brass? 6. What work on chemistry is the best? 7. How is phospho-tungstic acid made? Answers: 1. No difference, except that one contains gold and the other does not. If gold is present, it can generally be detected by the eye. 2. Gold is generally separated from quartz by crushing and grinding the rock into a fine flour; then by means of water the quartz is washed away, leaving the heavier gold in the vessel. There are other methods of separation. 3. Common sand does not contain gold. 4. Crucibles are made of black lead or graphite, also of clay. 5. By heat. 6. One of the best is Bloxam's. 7. We do not know what our correspondent means unless it be a mixture of phosphoric and tungstic acids.

J. H. K. says: I have an orchard of apple trees about 15 or 20 years old. For the last two or three years I have been greatly troubled by the ravages of the canker worm; and unless a stop is put to them, I shall probably lose the trees in a year or two. Please inform me if there is a remedy. Answer: The female of the canker worm is fortunately without wings, and is obliged to crawl up the trees to lay the eggs. If you can prevent this, you can put a stop to the depredations of this insect plague. Various methods have been devised for this purpose, such as the application of tar either directly to the bark itself, or on strips of cloth, paper, etc., wound around the trunk. Melted india rubber has been recommended in England, but we should think tin troughs filled with cheap oil, fixed to and encircling the whole trunk, near the ground, would be a good plan. This plan indeed has been tried with success on a small scale. When the worms are on the leaves, showering with a mixture of whale oil soap in water (1 lb. soap to 7 gallons water) will kill the worms without injuring leaves or fruit. See Dr. Harris on "Insects Injurious to Vegetation."

F. T. H. asks: What will take nitric acid stains from cloth? Answer: Try strong ammonia or hartshorn. Apply with a small piece of sponge or cloth and afterwards wash the place with water.

J. C. M. asks: How are grass and bouquets crystalized, so that they preserve the same form and color? Answer: What you mean is probably that the grasses or flowers are covered with some crystalline salt. This might be done by dipping them into or sprinkling upon them a strong warm solution of sugar or alum, letting each portion crystallize before the next is applied.

I. C. asks: Will a suction pump work satisfactorily in supplying water taken from a well about 200 feet distant horizontaly, with a perpendicular rise of say 22 or 23 feet? If so, what should the size of the pipe be, to cause the least outlay of labor in using the pump? Would it be preferable to lay the pipe according to the contour of the ground, or go to the additional expense of laying it nearly as regular in ascent as practicable, by deep cutting? Answer: A pipe one inch in diameter will answer, and it will be just as well to lay it according to the contour of the ground. The pump must be kept well packed, and will work satisfactorily, except that it will probably be a laborious operation for any one to furnish the requisite power. A small hot air engine, working a pump placed at the well and forcing the water to the house, is quite often employed in cases of this kind.

J. S. P. says: In your issue of July 19, C. M. P. says: "I have devised a machine which will grind a perfect lens of any size or shape." I should like to know how his machine is made, if he has no objection to publishing a description of it. I should like also an explanation of Professor Boyle's experiment which you referred to in the same paragraph. I don't understand how a polisher moving in cycloid curves can correct a spherical surface. Can you give a fuller description of Boyle's machine, or tell me where I can find such a description? Answer: A spherical refracting or reflecting surface must be converted into a paraboloid of revolution, before it will converge parallel rays to the same focus. This correction is accomplished by hand in the following manner: A disk of wood coated with pitch or rosin is worked with rouge in strokes across every diameter of the lens. The glass rests on an optician's post around which the operator walks, continuing the motion until the radius of curvature of the central part of the lens has been sufficiently shortened, so that the section curve becomes a parabola. Mr. Clark, who uses this method, makes the final correction by placing the lens over a paper disk marked with numbered concentric circles at intervals of a quarter of an inch; then, with his forefinger dipped in rouge, he rubs the glass gently in zones, guided by the numbered circles on the paper beneath. From time to time the glass is tried upon a star; wherever the zones are long focus, the touches are light; where they are short, the finger is pressed on hard. The machine for local correction, which Clark says works too rapidly for his use, moves the local polisher to and fro, and at the same time turns the lens gradually, so that the polisher traces hypocycloid curves of greater or less extent upon the glass. The finger, as it instantly detects a particle of grit, is not so likely to scratch the surface as the machine. The touch of the skilled optician as, with his forefinger dipped in rouge, he wipes away the superfluous glass, finds a curious parallel in that of the pholas, or burrowing mussel, which tunnels into granite with its soft foot, aided only by the abraded particles of the rock itself.

J. M. says, in answer to J. G., who asked how to solder broken files: They can be soldered with a common spirit lamp and blowpipe with common tinner's solder, after first cleaning the broken parts with muriate of zinc.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

P. S. H.—It is blue clay, a silicate of aluminum. If it burn white, it might be of value to the potters, in the manufacture of earthenware.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Hot Air Engine. By F. O. C.
On the Pulsometer. By E. D. W.
On the Patent Right Question. By W. F., and by C. H. A.
On a Device for Saving Fuel. By R. F.
On Interchangeable Parts. By B. F. S.
On the Million Dollar Telescope. By X.P.M.
On a Word to Apprentices. By F. H.
On the Manifestation of Energy. By W. D.

Also enquiries from the following:

P. R.—H. J. H.—B. L. B.—J. M. S.—C. de A.—A. B. C.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Correspondents in different parts of the country ask: Where can a magic lantern, for home use, be obtained? Where can machinery for making cheese boxes be had? Where are small rubber articles made? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

August 19, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air, carbureting, E. F. Van Houten	141,968
Air, etc., cooling, L. Schulze	142,046
Alarm, till, G. L. Geiger	142,012
Anchor for securing cores, Z. Ellis (r)	5,540
Animal matter, drying, C. C. Coe	141,853
Annunciator, C. H. Greenleaf	141,927
Annunciator, electrical, A. Storer	141,898
Auger, earth, W. H. Salyer	141,892
Bale tie, cotton, F. Cook	142,001
Baling hay, etc., wire tie for, G. L. Laughland	141,879
Ballot box, J. Gamber	141,872
Beer on draft, preserving, J. W. Moore	141,944
Bell pull, A. L. Swan	142,037
Bellows, W. Pilcher	141,888
Boats, folding frame for, W. M. Ducker	141,860
Bolt for safe doors, etc., W. Hall	141,874
Boot heel screw, W. Ackerman	141,908
Boot, plowman's, Walker & Brown	142,061
Boot sole edges, burnishing, J. Beasley *et al.*	141,984
Boot sole edges, burnishing, J. Beasley *et al.*	141,983
Boot sole edges, finishing, C. M. Chase	141,997
Boot sole edges, trimming, R. C. Lambart	142,029
Boot lift punching, G. W. Ellis (r)	5,539
Borer for sampling cotton, E. A. Clark	141,998
Boring machine, earth, J. Burns	141,916
Bottle stopper, L. Rhoades	141,950
Braking hoist, self, W. Hart	141,017
Brick machine, W. Cole	141,855
Bridge, ferry, C. J. Atkins	141,911
Bung, self-venting, C. F. Spencer	142,051
Button fastening, C. H. Reid	142,043
Can for oil, etc., J. R. Cole	141,920
Can, preserve, J. K. Chace	141,994
Cane juice with sulphur, treating, W. G. Billin	141,914
Car coupling, D. C. Camerer	141,991
Car coupling, F. J. Seybold	141,895
Car coupling, J. Temple	142,059
Car, dumping, J. Hughes	142,021
Car, dumping, J. Hughes (r)	5,541
Car lamp, J. E. Cross	141,856
Car railroad, J. C. Wands	142,062
Car truck, railroad, G. Dixon	141,859
Car trucks, kingbolt for, Murray & Lamason (r)	5,546
Carriage top, J. H. Snyder	142,050
Chair, self reclining, G. Niderkorn	142,089
Chair splints, making, J. B. Poe	141,948
Chuck, T. R. Almond	141,978
Churn dasher, reciprocating, T. Earle	142,007
Clamp, L. Feely	142,010
Clothes line holder, W. Cooke	141,921
Clothes wringer, centrifugal, H. Rosamyer, Jr.	142,045
Condenser, H. A. Towne	142,060
Cotton lint room, fireproof, R. R. Warren	142,065
Crib, W. B. Carpenter	141,918
Crimping clamp, P. A. Schoellhorn	141,956
Cultivator, A. C. Smith (r)	5,547
Cultivator, corn, N. G. Blauser	141,988
Cutter head, A. H. Shipman	142,048
Digger, potato, S. W. Tyler	141,903
Door closing apparatus, H. F. Shaw	141,896
Drawers, men's, E. L. Closse	142,000
Dressmaker's marking gage, M. Blauvelt	141,849
Eaves trough fastening, W. W. Hammond	141,016
Engine, portable steam, Schiedler & McNamar	141,955
Engine, rotary steam, O. Adams	141,909
Engines, regenerating steam in, F. M. H. Motard	142,038
Equalizer, three horse, T. Hoadley	141,875
Fertilizer, A. F. Andrews	141,848
Fiber from felt, removing, J. T. Waring	142,063
Fire place, W. Lossie	141,937
Firkin, C. Alvord	141,847
Fluting machine, E. M. Deey	141,923
Fork, horse hay, S. B. Bowen	141,851
Furnace, boiler, S. A. Ford	141,870
Furnace for smelting ores, E. Balbach, Jr.	141,912
Furnace grate, W. B. Le Van	141,936
Furnace grate, J. Withington	142,068
Furnace grate bar, A. Rawson	141,890
Furnace, soldering, W. S. Potwin	141,889
Gage, micrometer, A. Bonnaz	141,915
Game board, G. Wentz	142,066
Gas apparatus, railway car, J. B. Olney	141,886
Gas machine, air, P. Werni	141,973
Gas machine pulley, E. F. Van Houten	141,967
Gate, automatic, J. S. Folt	141,92[illegible]
Gate, automatic, J. E. Strong	141,900
Generator, steam, H. P. Wright	141,974
Glass furnace, W. Leighton, Jr.	141,935
Grain binder, A. Philippi	142,040
Grain steaming apparatus, Eberts & Pitts	142,008
Hammers, die for forming, J. Yerkes	142,070
Harness coach pad, A. Gilliam	141,873
Harrow, W. D. Summers	142,055
Harvester, O. Billings (r)	5,538
Harvester, J. H. Elward	141,863
Harvester, J. H. Elward	141,864
Harvester, J. H. Elward	141,865
Harvester, J. H. Elward	141,866
Harvester, J. H. Elward	141,867
Harvester, J. H. Elward	141,868
Harvester, S. Luce	141,938
Harvester, W. Wallace	141,970
Harvester wheel and axle, B. G. Turner	141,965
Hats and caps, dyeing felt, J. T. Waring	142,064
Hay tedder, T. J. & G. M. Clark	141,999
Heater, water, I. S. Mead	142,035
Hinge, E. Boileau	141,989
Hook, cant, F. Mansfield	142,082
Hook, cant, R. Whittier	141,906
Hook, fish, B. F. Allen	141,910
Horses from cribbing, preventing, A. Stilwell	141,962
Horseshoe nails, forging, F. H. Richards	142,044
Hose, etc., testing engine, P. Noyes	141,885
Hose, hydraulic, E. A. Street	142,054
Ice cream, jellies, etc., mold for, E. M. May	141,882
Jack, hoisting, J. H. Churchill	141,919
Kettle spout, tea, J. Ash (r)	5,537
Lamp, J. Kirby, Jr.	141,933
Lamp, advertising, F. R. Warner	141,971
Lamp extinguisher, F. C. Wireman	142,067
Lamp, hanging, G. Bohner (r)	5,534
Land marker, G. W. Betts	141,913
Latch, reversible knob, C. Moody	141,888
Lathe, turning, J. P. Luther	141,940
Lathes, centering device for, H. Gray	142,014
Lathing, metallic, T. O'Callahan	141,945
Leather work, seam for, C. Keniston	142,026
Level, pendulum, A. C. L. Delsarte	142,005
Lithographic stone, Moore & Bagger	141,943
Lock, combination, A. D. Hoffman	141,876
Log turner, C. Van Vleck	141,969
Loom, J. Zürcher	141,907
Lumber, machine for edging, W. G. Caldwell	141,852
Mallet, A. Holbrook	141,930
Match sticks, making, F. Zaiss (r)	5,548
Medical compound, P. H. Steenbergen	141,961
Metal bars, bending, S. Holmes	142,018
Milk, preserving, L. F. Kirchhoffer	141,878
Mill, rolling, Stephens & Cooper	142,052
Millstones, dressing, W. Farrow	142,009
Millstones, dressing, L. Randolph	141,949
Molding machine, H. B. Smith (r)	5,535
Mortar mixer, C. Pierce	141,947
Motor for driving machinery, A. N. Proctor	142,041
Mowing machine, W. S. Stone	142,053
Nut and bolt fastening, Antill & Sloan	141,980
Nut and bolt fastening, P. F. King	141,877
Ovens, reel for, A. Crumbie	142,003
Paint compound, F. A. Stall	141,897
Panels, machine for raising, F. D. Green	142,015
Panier, J. B. Colby	141,854
Pantaloon stretcher, L. Kaltenbacher	142,025
Paper bags, making, G. Dunham	141,862
Paper tubes, making, T. J. & J. T. Jones	141,932
Pipe coupling, L. T. Scofield	141,893
Pitman, O. F. Thomas	141,902
Plane, match, C. G. Miller	142,037
Planter, seed, B. Kuhns (r)	5,542
Plow, J. Marr	141,881
Plow, P. H. Starke	141,960
Plow coupling, T. L. Thrasher	141,984
Plow, wheel, L. W. Richardson	141,951
Power apparatus, foot, E. & H. Harding	141,928
Press, steam cloth, Dennis & Weston	142,006
Presses, mold or box for brick, J. McKenna	141,942
Propeller, screw, D. Freed	141,871
Pump, T. C. H. Kraus	142,028
Pump piston, W. C. Culbertson	142,004
Pump rod attachment, H. H. Locke (r)	5,543
Purifier, middlings, Hunter & Whitmore	142,022
Purifier, middlings, Hunter & Whitmore	142,023
Railroad rail, W. W. Alter	141,979
Railroad rail joint, J. L. Hudson	142,020
Railroad rail joint, W. D. Lindsley	142,030
Railroad water tank, J. Morton (r)	5,544
Railroad water tank, J. Morton (r)	5,545
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Saw, Luppert & St. Pierre	141,939
Saw hanging, J. E. Merritt	142,036
Saw teeth, setting, G. W. Bugbee	141,990
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Sawing machine, W. H. Shugart	141,989
Sawing machine, edging, E. Tarrant (r)	5,536
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Wood pulp making, S. B. Zimmer	141,976
Wool, pulling, J. Watteau	141,972

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,202.—PAPER PULP.—J. B. Palser *et al.* November 5.
26,329.—BOOT TIPS.—N. Silverthorn. November 12.
26,564.—CARRIAGE TOP PROP.—G. Cook *et al.* Dec. 10.

EXTENSIONS GRANTED.

25,183.—NAIL MACHINE.—Daniel Dodge.
25,191.—PAPER BAG MACHINE.—W. Goodale.
25,199.—FEEDING PAPER TO PRESSES.—R. M. Hoe.

DESIGNS PATENTED.

6,803.—BAND SAW FRAME.—L. M. Collins, Lebanon, N. H.
6,804.—GLASS GOBLETS.—J. H. Hobbs, Wheeling, W. Va.
6,805.—GLASS DISH.—J. H. Hobbs, Wheeling, W. Va.
6,806.—SEAL PRESSES.—C. A. Mathiesen *et al.*, N. Y. city.
6,807.—SAFETY STIRRUP.—R. Reniff, Bloomington, Ill.
6,808.—GASALIER.—J. F. Travis, New York city.
6,809.—GAS BRACKET.—J. F. Travis, New York city.
6,810.—OIL CLOTH.—J. Barrett, New York city.
6,811.—CARPET.—J. Dornan, Philadelphia, Pa.
6,812 to 6,818.—OIL CLOTHS.—J. Hutchison, Newark, N. J
6,819 to 6,823.—CARPETS.—C. A. Righter, Philadelphia, Pa
6,824.—CARPET.—J. T. Webster, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,410.—COTTON GIN.—Gullett Gin Mf'g Co., Amity City, La.
1,411.—FERTILIZERS.—M. J. Solomons, Savannah, Ga.
1,412.—PACKED OYSTERS, ETC.—Wentz *et al.*, Baltimore, Md.
1,413.—SELECTED NAILS.—J. Coyne, Pittsburgh, Pa.
1,414 to 1,415.—FANCY AND DRY GOODS.—E. Flaxland & Co., Paris, France.
1,416.—WINES, ETC.—S. McCullagh, London, England.

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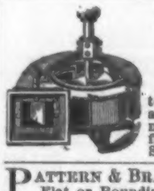

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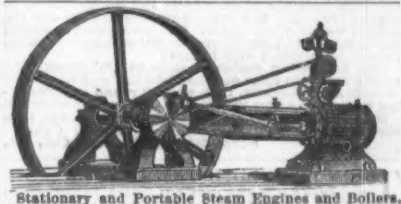

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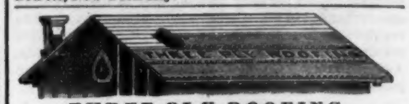

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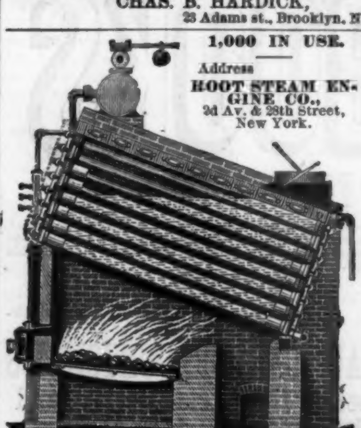

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